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State of Ohio Environmental Protection Agency

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MAR 31 1995
OFFICE OF RCRA
WASTE MANAGEMENT DIVISION
EPA, REGION V

March 30, 1995

Mr. Kevin Pierard, Chief
U.S. EPA, Region V
Ohio-Minnesota Technical Enforcement Section
Hazardous Waste Enforcement Branch, 5HS-12
77 West Jackson Boulevard
Chicago, Illinois 60604

Dear Mr. Pierard:

Please find enclosed the final CME for Vernitron Piezoelectric. This document, submitted in partial fulfillment of the 1995 RCRA grant commitment for second quarter, is based on a site inspection conducted on January 27, 1995. This document was prepared by Todd R. Fisher of the Division of Drinking and Ground Waters, Northeast District Office of the Ohio EPA, with the assistance of John Palmer of the Division of Hazardous Waste Management, Northeast District Office.

If you have any questions, please contact me at (614) 644-2905.

Sincerely,

Thomas Allen, Assistant Chief
Division of Drinking and Ground Waters

TA/KC/dr
COVER.CME

cc: Gordon Garcia, Project Officer, U.S. EPA, Region V
John Sadzewicz, Chief, DDAGW
Pam Allen, Manager, DHWM-CO (w/enclosure)
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Dave Wertz, Supervisor, DHWM-NEDO (w/enclosure)
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Laurie Stevenson, Supervisor, DHWM-CO
Lisa Koenig, Hydrogeologist, DDAGW-CO
Todd Fisher, Hydrogeologist, DDAGW-NEDO
John Palmer, Environmental Specialist, DHWM-NEDO
File

COMPREHENSIVE GROUND WATER MONITORING EVALUATION

OF

VERNITRON PIEZOELECTRIC INCORPORATED
(MORGAN-MATROC INCORPORATED)

CUYAHOGA COUNTY

BEDFORD, OHIO

OHD 052324290

OHIO ENVIRONMENTAL PROTECTION AGENCY

MARCH 31, 1995

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I. GENERAL INFORMATION

Purpose

This report documents the results of a Comprehensive Ground Water Monitoring Evaluation conducted at the Vernitron Piezoelectric (Morgan-Matroc) facility located in Bedford, Ohio. The objective of a CME is to determine whether the owner/operator has, in-place, a ground water monitoring program that is adequately designed, operated, maintained to detect releases or define the rate, extent, and degree of contaminant migration from a regulated unit as required by rules 3745-65-90 through 3745-65-94 and 3645-65-75(F) of the Ohio Administrative Code. This is the first CME of this facility, therefore the period of compliance under evaluation for this CME is from September 30, 1993, to March 1, 1995.

Information Sources

This report is based on an extensive record review and a site inspection conducted at the facility on January 27, 1995. The purpose of the inspection was to observe and determine the adequacy of the ground water sampling procedures, obtain ground water surface elevations, verify the number and location of monitoring wells, perform a surficial monitoring well construction and integrity inspection and review written records pertaining to the ground water monitoring program. The site inspection was conducted by: Todd R. Fisher, hydrogeologist (author), Division of Drinking and Ground Waters (DDAGW), Northeast District Office (NEDO), Ohio EPA; John B. Palmer, Division of Hazardous Waste Management (DHWM), NEDO, Ohio EPA; and Jeff Mayugh, DHWM, CO, Ohio EPA. Representing Vernitron Piezoelectric during the inspection were: Mr. William Hocevar, Mr. Ken Kupcak, Mr. R. Michael Wentzel, Mr. Doug Mehls, and Mr. John Hudak. Ms Deborah Romanowski of Simon Hydro-Search, Inc. was also present on behalf of Morgan Matroc, and addressed questions concerning the ongoing ground water monitoring system at the site.

In addition to information acquired during the site inspection and review of correspondence contained in Ohio EPA files, the following documents provided information upon which this CME report is based:

Crowell, Katie, Ground-Water Resources Map of Cuyahoga County, Ohio, Ohio Department of Natural Resources, Division of Water, 1979.

Ford, John P., Glacial and Surficial Geology Map of Cuyahoga County, Ohio, Ohio Department of Natural Resources, Division of Geologic Survey, 1987.

Ohio Department of Natural Resources, Division of Lands and Soil, An Inventory of Ohio

Soils - Cuyahoga County, Progress Report No# 54, 1978.

Simon Hydro-Search, Amended Closure Plan, Vernitron Piezoelectric Division, April 1993.

United States Department of Agriculture, Soil Conservation Service, Soil Survey of Cuyahoga County, Ohio, 1980.

Volmelker, Joel D., Bedrock Topography Map of Cuyahoga County, Ohio, Ohio Department of Natural Resources, Division of Geological Survey, Open File Map #118, 1981.

Inspection Checklists

Attached to this document are several checklists from the RCRA Comprehensive Ground Water Monitoring Evaluation Document (Directive 9950.2) and the Interim Status Ground Water Program Evaluation Document (SW-954). The checklists completed for this facility include:

Appendix A:	Comprehensive Ground Water Monitoring Evaluation Worksheet
Appendix A-1:	Facility Inspection Form for Compliance with Interim Status Standards Covering Ground Water Monitoring
Appendix A-2:	Inspection Compliance Form for a Facility That Has Determined It May Be Affecting Ground Water Quality

I. FACILITY HISTORY AND OPERATIONS

Facility Name   Morgan Matroc, Incorporated
formerly known as Vernitron Piezoelectric

U.S. EPA Identification Number OHD 052 324 290

(HWFB Number 02-18-0649)

Facility Location

The Morgan Matroc facility is a part of the southwestern quadrant of (Township) TP.6N., (Range) R.11W., in the proper of Bedford, Cuyahoga County, State of Ohio near the cities of Bedford and Oakwood. The street address is 232 Forbes Road, Bedford, Ohio, 44146. The facility is bordered to the north by Forbes Road, to the east by Free Avenue, to the south by wooded residential lots and to the west by a turf grass residential lot bordered by Wright Avenue. The facility can be located on the USGS Northfield, Ohio 7.5 minute series topographic map at a latitude of 41° 22′ 00″ North and 81° 31′ 15″ West (Figure 1).

Facility Description and Operations

Morgan Matroc is situated on an approximately 2.5 acre site. The site lies within an area of mixed residential, commercial and industrial use. The terrain is relatively flat, with paved roads on the front and one side, light woods behind, and an open meadow to the west.

Morgan Matroc manufactures ceramic piezoelectric elements in a variety of shapes, sizes and material compositions. Their products are primarily mechanical to electrical transducers, electrical to mechanical transducers, bandpass radio frequency filters, fuel ignition devices, and tone generators. The primary ingredients are oxides of lead, zirconium and titanium. The facility blends raw oxides in water, then dries the resulting paste. The material is calcined, ground in a ball mill, mixed with binders and spray dried. The material is then pressed or extruded and some parts receive rough machining. The parts are then bisque fired, followed by being high fired. Parts are then ground to specification. Some parts are cleaned in tetrachloroethene. Some parts undergo electroding, in which silver is silk screened onto the surface, or applied in a dipping step. Some parts undergo electroless nickel plating (no cyanide is involved). Parts are then placed in a bath and exposed to high voltage in order to polarize the materials. Tetrachloroethene again is used for cleaning, and final cutting and trimming takes place prior to shipment.

Morgan Matroc is classified as a Treatment/ Storage/ Disposal facility. Inside and outside drum storage areas were used for hazardous wastes. Ground water contamination originating from the outside drum storage area was discovered, and this area has been declared a land disposal facility. The units are currently undergoing RCRA closure.

The facility was originally known as Vernitron Piezoelectric. Operations began at this site on June

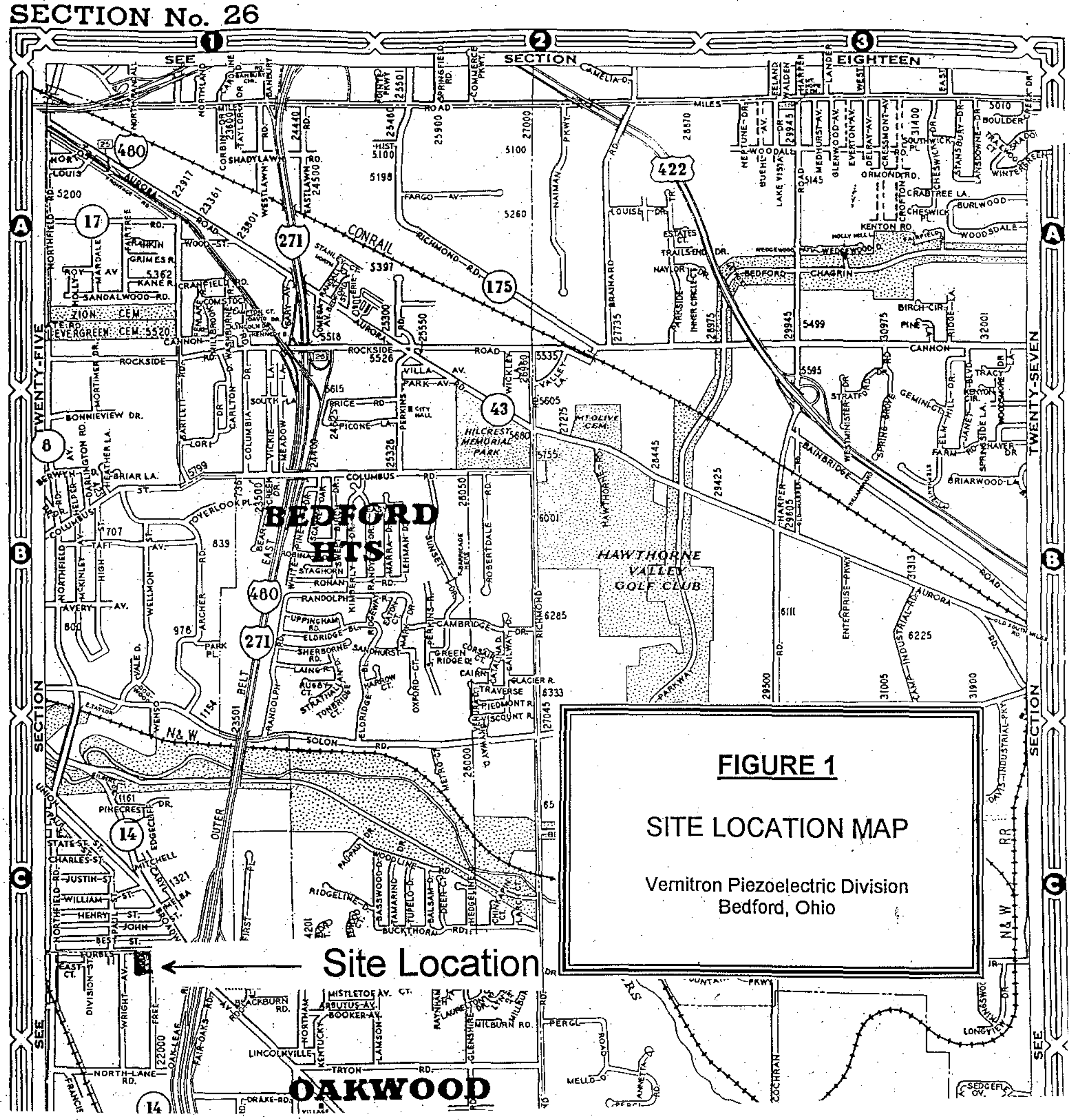

Figure 1. Site Location Map

2, 1958. The facility was purchased by M.M. Piezo Products (Morgan Matroc) on July 27, 1989, and Morgan Matroc acquired title to the closure units. Vernitron Piezoelectric contractually retained responsibility for the RCRA units, and is currently performing activities which are intended to lead to certification of the units as closed. However, the Ohio Environmental Protection Agency (Ohio EPA) will hold Morgan Matroc (as holder of the title to the property) ultimately liable for the closures if Vernitron Piezoelectric defaults on the contract.

For consistency throughout this document, the facility will be referred to as Vernitron Piezoelectric.

A plan view of the facility showing the two RCRA drum storage units is presented in Figure 2. The outside storage area is the RCRA unit subject to this CME. The "treatment areas" illustrated are waste water treatment areas, and are not relevant to this CME.

Hazardous Waste Generated

A list of the major waste streams generated at Vernitron Piezoelectric follows (based on information gathered during a January 27, 1995 inspection):

1) . . The facility generates approximately 55,000 kilograms per year of fired ceramics and parts contaminated with lead. These materials are generated at all points in the process. These materials are containerized and manifested off site to Schuylkill Metals of Baton Rouge, Louisiana for reclamation. These materials appear to be by-products exhibiting a characteristic of hazardous waste. Since they are being sent off site to be processed to reclaim a usable product (lead), the facility does not appear to be accumulating these materials speculatively, and the facility appears to handle them in a manner which is consistent with them being of value, these materials appear to be exempt from RCRA regulation per Ohio Administrative Code (OAC) Chapter 3745-51-02 (C) (3).

2) . . The facility generates a quantity of sludge contaminated with lead (the quantity of material generated is included in the total figure given for waste stream number one). These materials are generated during wash down and clean-up. A waste water treatment plant filter press is the source of the wash down sludge. These materials are containerized, and manifested off site to Schuylkill Metals of Baton Rouge, Louisiana for reclamation. These materials appear to be sludges exhibiting a characteristic of hazardous waste. Since they are being sent off site to be processed to recover a usable product (lead), the facility does not appear to be accumulating these materials speculatively, and the facility appears to handle them in a manner which is consistent with them being of value, these materials appear to be exempt from RCRA regulation per OAC 3745-51-02 (C) (3).

3) . . The facility generates approximately 1100 kilograms per year of fired ceramics and parts contaminated with silver and lead, and mixed materials containing silver, lead, platinum and brass. These materials are generated at all points in the process. These materials are containerized, and manifested off site to Vanguard Research Industries of South Plainfield, New Jersey for reclamation of the silver and platinum. After precious metals reclamation, these materials are returned to Vernitron Piezoelectric, and then manifested off site to Schuylkill Metals for lead reclamation. These

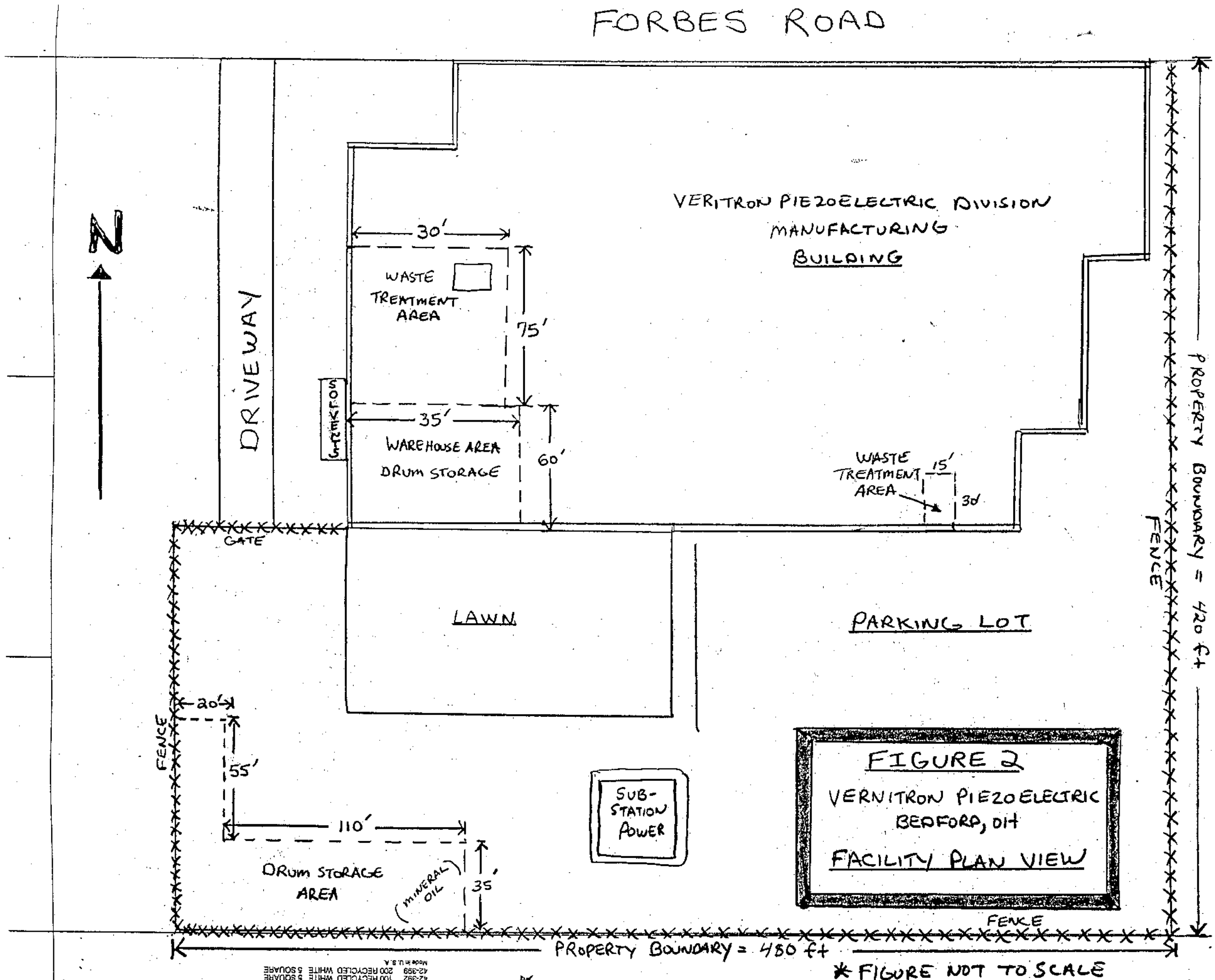

FIGURE 2
VERNITRON PIEZOELECTRIC
BEDFORD, OH
FACILITY PLAN VIEW

materials appear to be by-products exhibiting a characteristic of hazardous waste. Since they are being sent off site to be processed to reclaim a usable product (silver, platinum, and lead), the facility does not appear to be accumulating these materials speculatively, and the facility appears to handle them in a manner which is consistent with them being of value, these materials appear to be exempt from RCRA regulation per OAC 3745-51-02 (C) (3).

4) .. The facility generates a quantity of clothing, sweepings, air filter bags and cartridges, respirator cartridges, waste shipping containers, paper hand towels, wiping rags and sponges, contaminated pallets, and miscellaneous materials contaminated with lead, silver or solvents. Approximately 10 to 15 cubic meters per year of lead contaminated materials (D008) are manifested off site to Envotech Management Services of Belleville, Michigan. Approximately 2200 kilograms per year of silver contaminated materials (D011) are manifested off site to Vanguard Research Industries (these materials are destroyed in Vanguard's process, and not returned to Vernitron Piezoelectric). Approximately 320 kilograms per year of tetrachloroethene contaminated materials (F001) are manifested off site to Ensco of Eldorado, Arkansas. These materials are RCRA hazardous wastes.

5) .. The facility generates approximately 9000 kilograms per year of spent tetrachloroethene (F001). This material is generated during degreasing and cleaning operations. This material is containerized, and manifested off site by Liberty Solvents of Twinsburg, Ohio to Northeast Chemical of Cleveland, Ohio for reclamation. This material is a RCRA hazardous waste.

6) .. The facility generates spent mineral oils and hydraulic oils which appear to be non-hazardous. These materials are containerized, and sent off site to Chem Met Services of Wyandotte, Michigan for fuel blending.

7) .. The facility generates approximately 7500 to 15,000 Liters per year of spent electroless nickel plating solution. This material is containerized, and sent off site to Envotech Management Services. This material appears to be a non-hazardous, nickel containing liquid.

8) .. The facility generates approximately 270 kilograms per year of spent Isoprep 201™ containing sulfuric acid, nitric acid and chromium compounds (D002 and D007). This material is generated from a plating operation. This material is containerized, and manifested off site to Cyanokem of Detroit, MI. This material is a RCRA hazardous waste.

9) .. The facility generates approximately 1200 kilograms per year of spent isopropyl and ethyl alcohols (D001). This material is generated from cleaning operations. This material is containerized, and manifested off site by Liberty Solvents of Twinsburg, Ohio to Northeast Chemical of Cleveland, Ohio for eventual incineration in a cement kiln. This material is a RCRA hazardous waste.

10) . The facility generates approximately 230 kilograms per year of spent Orange Terpene™ (Terpineol). This material is generated from clean up during the silver electroding process, and appears to be characteristically hazardous for silver (D011). This material is containerized and manifested off site to Vanguard Research Industries of South Plainfield, New Jersey (this material is

destroyed in Vanguard's process, and not returned to Vernitron Piezoelectric). This material is a RCRA hazardous waste.

11) . The facility episodically generates saggers from firing processes and fire bricks from their kilns which are contaminated with lead (D008). These materials are manifested off site to Chem Met Services of Wyandotte, Michigan. These materials are RCRA hazardous wastes.

12) . General solid wastes and sharps (used hypodermic needles from the employee blood sampling program) are managed by Browning Ferris Industries.

13) The facility generates spent plating solutions which are high in lead content. These solutions are disposed of in the on-site waste water treatment plant. These materials therefore appear to be exempt from RCRA regulation per Ohio Administrative Code Chapter 3745-51-04 (A) (2).

14) . Fines from an air scrubber cyclone which are high in lead are charged as an ingredient directly back into the process to make a product. No reclamation occurs prior to its use in the process. This material therefore appears to be exempt from RCRA regulation per Ohio Administrative Code Chapter 3745-51-02 (E) (1) (a).

Specific hazardous waste constituents of concern identified in the outside drum storage unit include at least trichloroethene, tetrachloroethene, and possibly lead, silver, arsenic, cadmium, chromium, mercury, and methylene chloride (dichloromethane).

Hazardous Waste Treatment, Storage and Disposal Practices

Hazardous wastes generated during various production processes were placed into containers and stored in both an inside and an outside drum storage area (illustrated in Figure Two as "Drum Storage Area"). Only the outside storage area is subject to OAC 3745-65-90 through 94. Now, hazardous wastes are managed entirely inside the building in less than ninety day accumulation areas and satellite accumulation areas. The hazardous wastes are then either manifested off site to a permitted Treatment/ Storage/ Disposal facility or sent off to reclamation facilities. The waste streams generated and their off site management have not essentially changed historically. Management of the wastes on-site has changed in that wastes are no longer kept outside, and are no longer stored over ninety days. Vernitron Piezoelectric also eliminated two Freon™ containing waste streams altogether, and is making efforts to reduce the quantity of tetrachloroethene waste generated.

Regulatory History

Vernitron Piezoelectric submitted a Notification of Hazardous Waste Activity on August 13, 1980. Part A of the permit application was received by the Ohio EPA on December 1, 1982. The Ohio Hazardous Waste Facility Board also issued a hazardous waste facility installation and operation permit (02-18-0649). The Part A included the regulated units addressed by the CME.

Interim status was granted to Vernitron Piezoelectric by the United States Environmental Protection Agency (USEPA) in documents dated May 4, 1982 and July 11, 1983.

Vernitron Piezoelectric had two drum storage units, one inside and one outside (Figure Two). A closure plan for the two storage units was received by the Ohio EPA on October 25, 1982.

In December, 1986, Vernitron Piezoelectric submitted a Hazardous Waste Management Plan in which they requested withdrawal of their Part A and Interim Status, and their intent to close the RCRA units and downgrade to generator status. A clean closure plan for the units was included, and received by Ohio EPA on December 16, 1986. This closure plan was approved with modifications by the Ohio EPA on May 7, 1987. The Ohio EPA Conditional Approval was in turn approved by the USEPA on June 9, 1988.

Closure activities commenced in August of 1988. During the course of the field work, Vernitron Piezoelectric discovered that the extent of contamination attributable to the outside drum storage area was far greater than anticipated. More field work took place in November, 1988.

In April, 1989, Vernitron Piezoelectric performed more field sampling, and in April, May and June installed four ground water monitoring wells. These investigations revealed that both the soils and the ground waters around and under the unit were contaminated.

Around July 10, 1989, Vernitron Piezoelectric was referred to Ohio EPA's Central Office for possible enforcement action arising from (primarily) on-going financial assurance requirements violations and from operating requirements violations. The Ohio EPA and Vernitron Piezoelectric reached a settlement, and Director's Final Findings and Orders were journalized on July 18, 1990. Vernitron Piezoelectric appears to have fully complied with the terms of the Director's Final Findings and Orders. No ground water related issues were included.

On December 19, 1989, the Ohio EPA received an amended closure plan from Vernitron Piezoelectric. This amended closure plan was offered for public inspection in a public notice dated June 11, 1990. A Notice of Deficiency dated January 8, 1991 was issued to Vernitron Piezoelectric in response to this submittal.

On June 3, 1991, in response to a Notice of Deficiency, Vernitron Piezoelectric submitted a revised amended clean closure plan to the Ohio EPA.

In response to the revised amended closure plan, the Ohio EPA issued a Notice of Deficiency dated February 13, 1992 to Vernitron Piezoelectric.

On June 29, 1992, in response to a Notice of Deficiency, Vernitron Piezoelectric submitted a second revision to the amended closure plan to the Ohio EPA.

The Ohio EPA's Division of Ground Water issued an extensive review of the second revision to the amended closure plan on September 28, 1992. Based on these comments, and based upon an Ohio

EPA Division of Hazardous Waste Management review, over fifty draft comments were prepared. These comments, in draft form, were conveyed to Vernitron Piezoelectric on February 9, 1993.

On June 8, 1993, in response to the draft comments, Vernitron Piezoelectric submitted a third revision to the amended closure plan and a ground water quality assessment plan. The Division of Ground Water issued comments on the plan dated August 19, 1993. Based on these comments, and based upon an Ohio EPA Division of Hazardous Waste Management review, the Director of the Ohio EPA issued a Conditional Approval dated September 30, 1993.

On October 29, 1993, the Ohio EPA received an updated copy of volume one of the closure plan, revised to incorporate the modifications contained in the Conditional Approval. Various comments and responses were exchanged between Ohio EPA and Vernitron Piezoelectric through March, 1994.

Field and sampling activities were conducted the week of June 13, 1994. As of December 20, 1994, the Ohio EPA had not received a report on the results of these activities.

III. REGIONAL AND SITE HYDROGEOLOGY

Regional Hydrogeologic Setting

The facility lies in the glaciated portion of the Allegheny Plateau physiographic province. The geology of this area is characterized by relatively horizontal, sedimentary rock consisting of sandstones, shales, and siltstones of Mississippian age. The bedrock is overlain by varying thicknesses of poorly-sorted Wisconsinan tills that are interbedded with sands, gravels, clays, and silts (Simon Hydro-Search, 1993). Specifically, the primary glacial deposit in the vicinity of the site is the Lavery Till which is silty to clayey, strongly calcareous, and cohesive. Occasionally, the younger Hiram Till may be identifiable in local outcrops, but in most places is thinner than the modern soils. Older tills may be present in extensive outcrops and in the subsurface.

According to the Soil Survey of Cuyahoga County (1980), soils in the vicinity of the site are characterized as Mahoning-Urban land association. Urban land is covered by streets, parking lots, buildings, and other structures such that the soils are obscured and unidentifiable. Mahoning soils are medium textured and somewhat poorly drained. Soil permeability is slow to very slow and perched seasonal high water tables may occur at depths of 12 to 30 inches. These soils tend to be deep and occur in broad undulating areas on till plains and on higher parts of lake plains.

The uppermost bedrock unit underlying the site is the Orangeville Shale of the Cuyahoga Formation (Mississippian Age) (Winslow, et. al., 1953). This shale is characterized as soft, uniform, dark blue-gray to tan-gray, and fissile. Directly underlying the Orangeville Shale lies the Berea Sandstone (Mississippian age).

Ground water in the area is obtained from the shales of the Cuyahoga Formation (Crowell, 1979). Yields of 3 to 10 gallons per minute can be encountered less than 30 feet below the surface. Water occurs primarily along bedding planes and in fractures (Simon Hydro-Search, 1993). Bedrock is encountered at a depth between 18 and 25 feet below the ground surface (Volmelker, 1981). Ground water resources also can be developed from the underlying Berea Sandstone in wells advanced to 75 to 123 feet below the surface. The Berea Sandstone is interpreted by the Ohio Department of Natural Resources as a confined aquifer.

Site Geology and Hydrogeology

Well logs for the three monitoring wells installed in 1989, indicate that the facility is underlain be approximately 10 feet of moist, silty clay (unconsolidated, possibly semi-confined aquifer). The clay is underlain by a weathered Orangeville Shale (a confining layer at depth). The deepest well was drilled to 15 feet below the ground surface. All wells were completed at the shale/till interface. Monitoring well locations are shown in Figure 3. Using the water level elevation data collected in 1989, a northeast to southeast ground water flow direction was calculated for the site (Figure 4).

Ground water was encountered from 3.75 to 4.83 feet below the ground surface, which is several feet above where the first significant ground water zone was encountered.

Additional ground water elevation data were collected on January 26 and January 30, 1994. Figures 4 and 5 are piezometric surface maps (with flow lines) that were constructed from the January data. The water level elevation data collected in 1995 indicate that the ground water flow direction may shift locally toward the southeast in the vicinity of MW-3. This apparent shift in ground water flow direction may be the result of seasonal or temperal variations. However, insufficient water level elevation data currently exist to define such variations. Recently the wells were modified from a flush mounted completion to an above ground completion. It is also possible that the apparent shift in ground water flow direction may be the result of a surveying error of the reference point. A ground water elevation data summary (1989-1995) is provided in Table 1.

Table 1. Ground Water Elevation Data Summary (1989 - 1995)

Well No.	Measuring Point	06/12/89	06/15/94	01/26/95	01/30/95
MW-1	TOC, 100.64	94.39	94.38	94.95	95.05
MW-2	TOC, 101.34	94.67	93.54	95.09	95.13
MW-3	TOC, 101.28	93.48	93.25	95.09	95.08
MW-4	TOC, 102.64	Not Installed	Not Installed	96.32	96.38
MW-5	Not Installed	---	---	---	---
MW-6	Not Installed	---	---	---	---
MW-7	Not Installed	---	---	---	---

*** All top of casing (TOC) elevations were measured in reference to an on-site datum of 100.0 feet

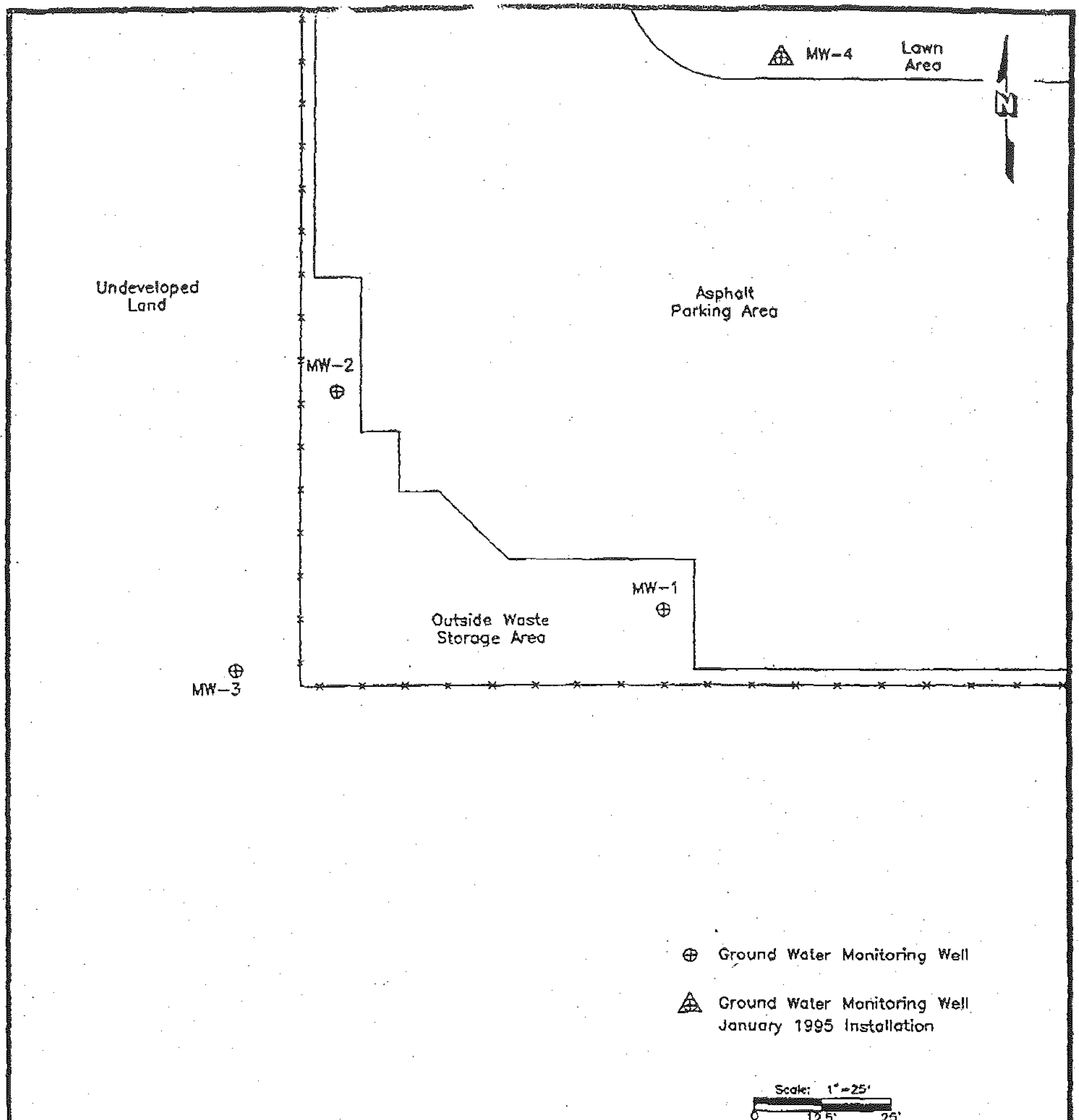

Figure 3. Monitoring Well Location Map

VERNITRON PIEZOELCTRIC DIV. BEDFORD, OHIO	DATE: 01/16/95
	DESIGNED:
MONITORING WELL LOCATION MAP	CHECKED:
	APPROVED:
	DRAWN: DBS
	PROJ.: 804678.0001
HYDRO-SEARCH, INC. A Tetra Tech Company	

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MONITOR WELL NO.	RELATIVE ELEVATION OF WELL CAP (FT)	DEPTH TO GROUNDWATER (FT)	RELATIVE ELEVATION OF GROUNDWATER (FT)
1	98.14	3.75	94.39
2	98.84	4.17	94.67
3	98.31	4.83	93.48

(measured 6/12/89)

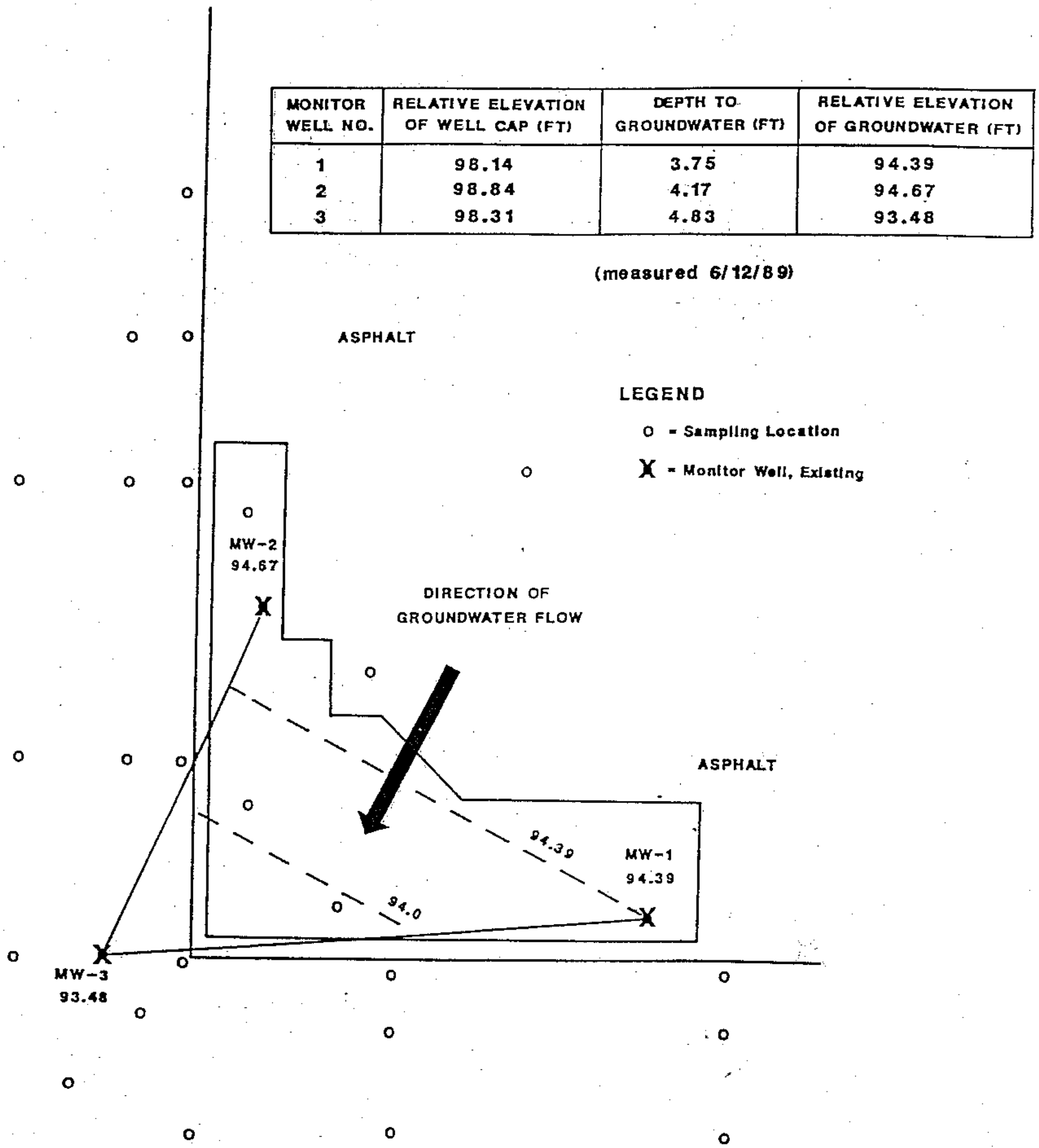

Figure 4. Piezometric Surface Map (06/12/89)

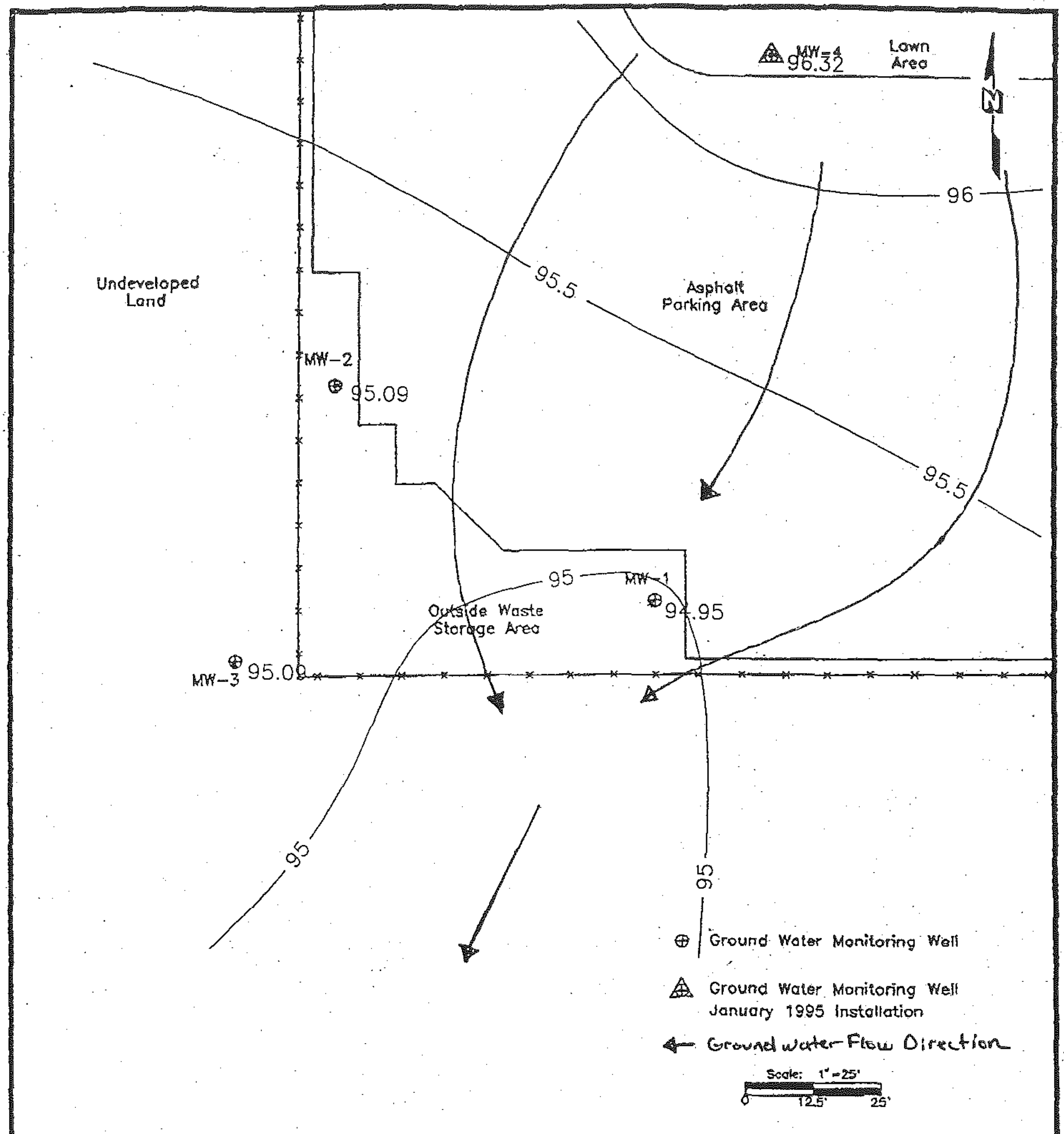

Figure 5. Piezometric Surface Map (01/26/95)

VERNITRON PIEZOELCTRIC DIV. BEDFORD, OHIO	DATE: 01/16/95
MONITORING WELL LOCATION MAP	DESIGNED:
	CHECKED:
	APPROVED:
	DRAWN: DBS
	PROJ.: 804678.0001
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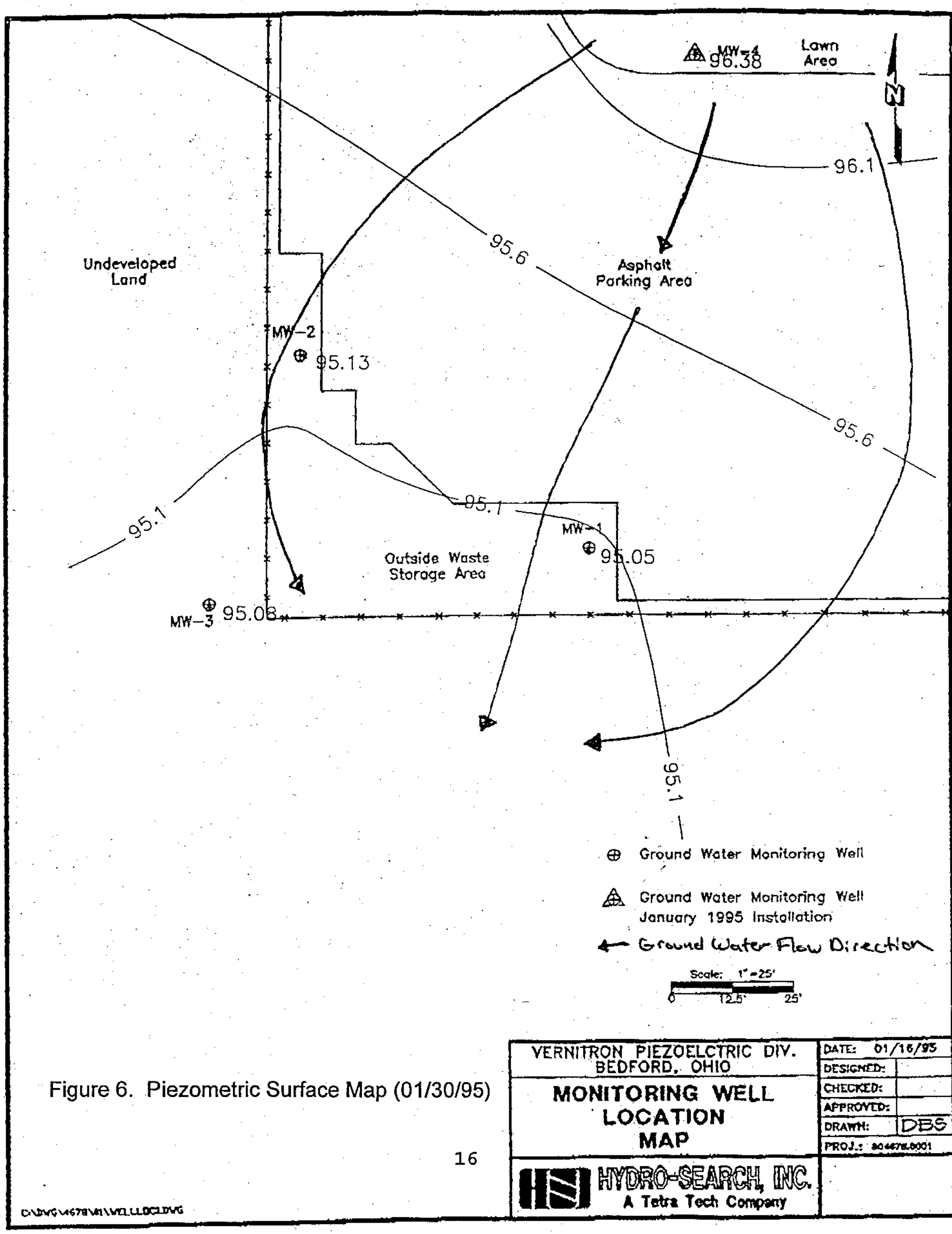

Figure 6. Piezometric Surface Map (01/30/95)

IV. GROUND WATER MONITORING SYSTEM

Ground Water Monitoring History

Clean closure activities for the two drum storage areas commenced in August of 1988. During the course of the field work, Vernitron Piezoelectric discovered that the extent of contamination attributable to the outside storage area was far greater than anticipated. In November 1988, more field work took place to determine the rate and extent of contamination in both soil and ground water. More field sampling was performed in April 1989. In addition, four ground water monitoring wells were installed at the site in April, May, and June 1989. One of the monitoring wells, MW-3, adjacent to soil boring location #62 was abandoned due to well development problems. This well was replaced with another well also designated MW-3. Three additional monitoring wells (MW-5 through MW-7) will be installed hydraulically downgradient from the outside drum storage area in the near future, once the ground is solid enough for drilling rig accessablility. All installed site monitoring wells will be used to evaluate and monitor the uppermost aquifer as specified by 3745-65-90 (A) of the Ohio Administrative Code (OAC). In 1992, based on the results of samples collected from MW-1, -2, and -3 and analyzed in 1989, the Ohio EPA directed the company to develop and implement a Ground Water Quality Assessment Program (GWQAP) in Accordance with OAC 3745-65-93 (D).

Monitoring Well Placement

Four monitoring wells (MW-1 through MW-4) have been installed at the site (see Figure 3). These wells are installed in the uppermost aquifer as specified by rule OAC 3745-65-90(A). These wells were found to be located at their reported locations.

Upgradient, background well, MW-4, is located just northeast of the outside drum storage area, approximately 50 feet upgradient of the boundary of detectable VOC concentrations found during the soil vapor survey described in Section 4.1 of the approved Amended Closure Plan.

It appears that the placement of monitoring well MW-4 is hydraulically upgradient from the outside drum storage area, however, because the results of the initial sampling of this well have not yet been received by the Ohio EPA, the company has not demonstrated that the ground water from this well is representative of background water quality, unaffectd by the facility as specified in rule 3745-65-91 (A)(1)(a) and (b) of the OAC.

Monitoring wells MW-1 and MW-2 are installed within the limits of the outside drum storage unit. Well MW-2 is located in the northern corner of the unit and MW-1 is located in the eastern corner of the unit. Well MW-3 is located outside the southwestern limits of the unit. Additional water level elevation data are needed to determine if seasonal and temperal variations may be affecting the direction of ground water flow at the site. In addition the monitoring wells recently were changed from a flush mounted completion to an above ground completion. The January 1995 water level elevations are the first such data collected since the wells were modified. The change in ground water flow direction may also be the result of an error in the surveying of the reference measurement point. This should be investigated by the company. If the ground water flow direction calculated using the 1995 water level elevation data is correct, the company may not have in place a ground water monitoring system that meets the requirements of OAC 3745-65-91 (A)(2). However, additional investigation is needed to determine if this is a seasonal or temporal phenomonon, the result of a surveying error, or a permanent change in the hydraulic conditions at the site.

As part of the GWQAP three additional monitoring wells, MW-5, MW-6, and MW-7, will be installed downgradient of the investigation area. These wells will be placed slightly downgradient of the boundary of detectable VOC concentrations determined during the soil vapor survey.

Monitoring Well Installation and Construction

Monitoring wells MW-1, MW-2, MW-3, and MW-4 were drilled to a specified depth using 10-inch inner diameter (I.D.) hollow-stem augers. Soil samples were collected continuously in advance of the bit using a 2-foot split-spoon sampler. Each sample collected was visually classified by a qualified geologist and these descriptions were recorded on boring logs. These descriptions included applicable information such as soil type, organic material content, grain size distribution, gradation, plasticity, color, moisture content, odor, and PID measurements (Simon Hydro-Search, 1993).

Drilling continued in all borings until competent shale bedrock was encountered. The total depth of the borehole was determined using a tape measure (Simon Hydro-Search, 1993).

All drilling equipment was decontaminated between wells by steam-cleaning. Soil sampling equipment was decontaminated by steam-cleaning or washing with a non-phosphate detergent, rinsing with tap water, and then Type II reagent grade water between each sample location and depth (Simon Hydro-Search, 1993).

Soil cuttings and other solid materials collected during the drilling activities was temporarily stored in 55-gallon drums or composited with excavated soils being disposed of as hazardous waste. The solids were adequately characterized and disposed of properly in accordance with all applicable regulations. Solids generated during drilling activities, if disposed of separately from excavated materials being handled as hazardous waste, were characterized for disposal by analyzing for, at a minimum, TCLP metals and volatile organic compounds (Simon Hydro-Search, 1993).

Monitoring wells were constructed of new 4-inch I.D. Schedule 40, flush-threaded polyvinychloride (PVC). Well casings, couplings, and screens sealed in factory plastic were used in the construction of the monitoring wells. A slot size of 0.010-inches was selected for each well. Monitoring wells MW-1, MW-2, and MW-3 were constructed with 10-foot screens, whereas, monitoring well MW-4 was constructed with a 5-foot screen. All screens were placed at an approximate depth of 5-15 feet below ground surface in the zone of saturation above the bedrock shale (weathered shale / till interface)(Simon Hydro-Search, 1993).

The sand filter pack was placed within the well annulus, from the bottom of the screen to approximately one foot above the top of the
screen. The sand pack was installed through the hollow-stem augers, as the augers were withdrawn. A 2-foot bentonite pellet seal was placed above the sand filter pack and hydrated in 6-inch intervals. Concrete was used to fill the annular space around the well casing from just below the frost line (3 feet below grade) to the ground surface and extending into an apron (well pad) around the well head. The annular space below the concrete and above the bentonite seal was filled with a cement-bentonite grout mixture (Simon Hydro-Search, 1993).

Originally, flush-mounted protective covers were installed in monitoring well MW-1, MW-2, and MW-3, however, in January of 1995 the same monitoring wells were retro-fitted for steel locking "stick-up" protective casings. All monitoring wells on site now have PVC well casings that extend to at least 20 inches above grade and protective steel covers with locking caps. Bumper guards were provided where necessary for protection from vehicular traffic. Bumper guards consist of four guard posts (3 or 4 inch diameter steel pipe, concrete filled) evenly spaced around the perimeter of the concrete well pad. A weep hole was installed through the protective cover to facilitate drainage of ponded water and to prevent ice from forming during the winter months (Simon Hydro-Search, 1993).

Monitoring well construction information is provided in Table 2. A typical well construction diagram for the installed monitoring wells is provided in Figure 7.

Monitoring Well Maintenance

During the CME inspection (01/27/95), a surficial inspection of the integrity of the monitoring wells was conducted. No maintenance

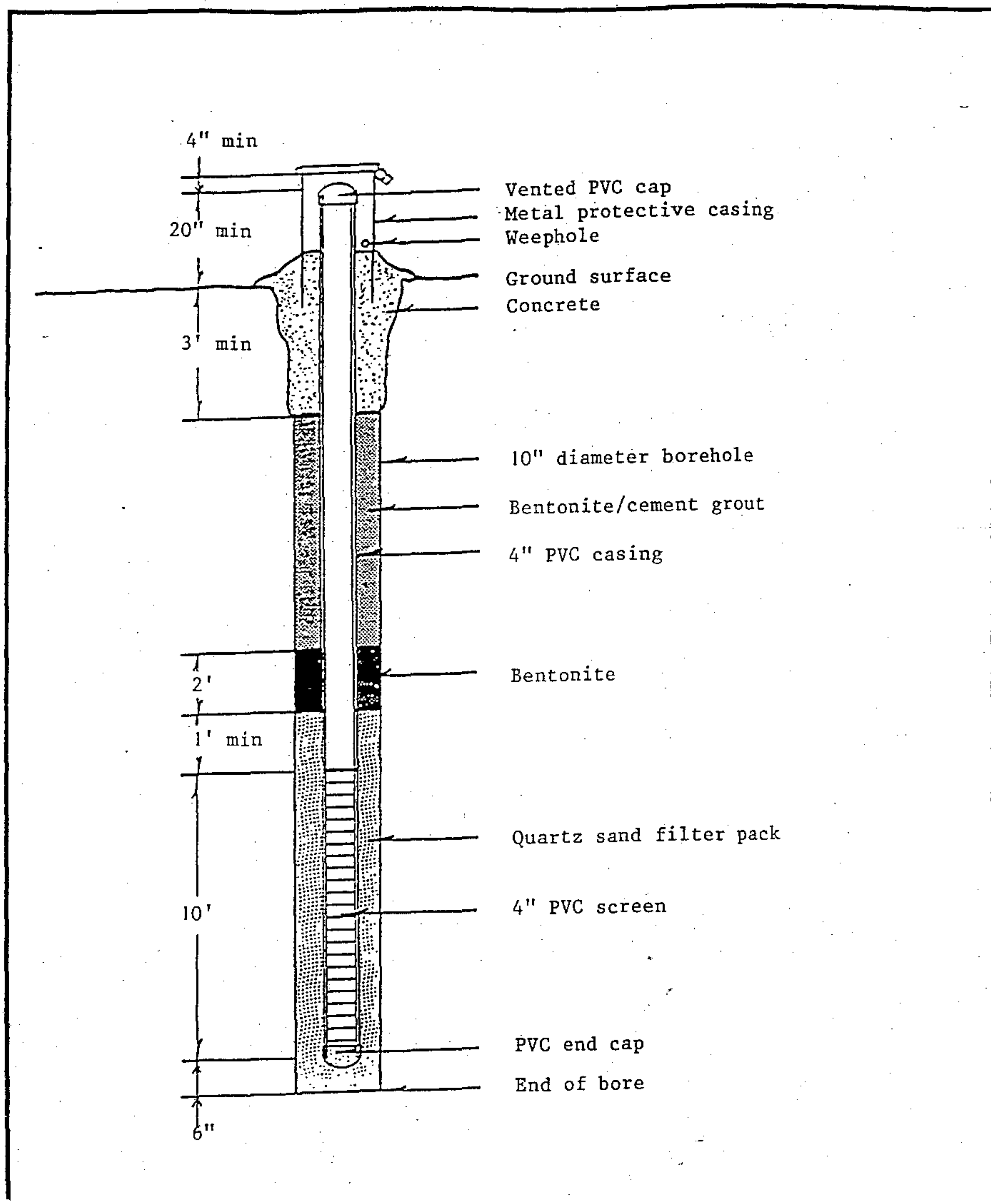

Figure 7. General monitoring well construction diagram.

Table 2. Monitoring Well Construction Information

Well #	Grade	Top of Casing	Stickup	Boring Depth	Screen Depth	Screen Elevation	Screen Length	Casing Screen	Screen Slot Size	Filter Pack	Filter Pack Length	Grout	Drilling Method	Drilling Fluid	Dev. Tech	Date Installed	Installed By
1	—	100.64'	yes	15'	10'	—	10'	PVC	0.010"	SAND	2'	1'	HSA	NONE	—	April 89	Toxcon
2	—	101.31'	yes	15'	10'	—	10'	PVC	0.010"	SAND	2'	1'	HSA	NONE	—	April 89	Toxcon
3	—	101.28'	yes	15.5'	10'	—	10'	PVC	0.010"	SAND	2'	1'	HSA	NONE	—	April 89	Toxcon
4	—	102.64'	yes	—?	—?	—	5'	PVC	0.010"	SAND	—?	1'	HSA	NONE	—	Jan 95	PSI

problems (i.e., unlocked well covers, damaged concrete collars, etc.) were identified at the time of the inspection. It appears that the monitoring wells installed at the site have been properly maintained to meet the minimum requirements of rule 3745-65-91(C) of the OAC.

V. SAMPLING AND ANALYSIS PLAN AND PROCEDURES

Sampling and Analysis Plan

The sampling and analysis plan (SAP) was approved as a section of the closure plan on September 30, 1993. The SAP was reviewed and evaluated in accordance with the requirements specified in rule 3745-65-92(A) of the OAC. No deficiencies were encountered. During the CME inspection, it was confirmed that the SAP was kept on site at all times.

Field Evaluation of Sampling and Analysis Procedures

A field evaluation of sampling and analysis procedures took place during the CME inspection on January 27, 1995. Vernitron's consultant Simon Hydro-Search was present during the site inspection and demonstrated sampling procedures by purging and sampling MW-4 (newly installed). Purging, water level measurements, and sampling was performed earlier in the week for all monitoring wells currently installed on site. The following procedures were performed and observations recorded for MW-4 during the inspection.

Before MW-4 was purged, a Keck oil/water interface probe was lowered into the well to obtain water level data and to confirm whether or not the presence of light non-aqueous phase hydrocarbons exist. A bottom of the well measurement was also taken to determine the length of the water column in the well and also to determine whether or not fines have settled out into the well. The volume of the well was calculated and three to five well volumes were removed and containerized before the ground water samples were collected. A dedicated polypropyline disposable bailer was used to purge the well.

After the appropriate number of well volumes were removed, a decontaminated Teflon bailer was used to collect the ground water samples. Decontamination of all sampling equipment was performed by first using a non-phosphated detergent, then a tap water rinse, followed by a final Type II reagent water rinse.

First, the VOC sample was collected by very gently lowering the bailer into the well. The sample was retrieved by the bailer and then transferred to 40 ml vials via a bottom spigot. The transfer occurred very slowly to minimize agitation and volatization of possible contaminants. Each vial contained hydrochloric acid as a preservative. A positive meniscus was created in the vial and the cap was screwed on tightly to prevent the formation of air bubbles. The sample vials were then appropriately labeled and placed into a cooler with ice.

Lastly, the lead sample was collected using a Teflon bailer with bottom spigot. The sample was withdrawn from the bottom of the bailer using a hand pump and transferred through a 0.45 micron filter directly into the sample container. The sample was then preserved with nitric acid, labelled, then placed in the cooler for shipment to the laboratory.

VI. ASSESSMENT MONITORING PROGRAM

Assessment Monitoring Program Description

The ground water quality assessment plan (GWQAP) was approved on September 30, 1993, as part of the closure plan after several revisions were submitted to the Ohio EPA. The GWQAP can be found in the approved amended closure plan. The assessment monitoring program was initiated after it was discovered that the outside drum storage area had adversely affected ground water under the facility. Currently, the facility is determining the rate and extent of this contamination in the uppermost aquifer. The present ground water monitoring system is comprised of one upgradient monitoring well and three downgradient monitoring wells. However, the facility is in the process of implementing the GWQAP (Phase A) which call for three additional monitoring wells to be located directly downgradient of the outside drum storage area. If the extent of the ground water contamination cannot be determined with the addition of these three wells, additional monitoring wells will be required as specified under later phases (i.e., Phase B, to be submitted later).

Ground Water Quality Assessment Plan/Implementation

The GWQAP was approved as part of the amended closure plan on September 30, 1993. Specifically, the GWQAP requires that samples are collected quarterly for a minimum period of three years and analyzed for volatile organic compounds (VOCs)(Method 8240) and lead (Method 7421) according to SW-846 methods and protocols. The use of indicator parameters are not required under the approved GWQAP.

According to the closure schedule in the approved amended closure plan, project preparation, field testing, soil sampling and analysis, well installation, well sampling, and ground water analysis should have been initiated two months after the closure plan approval date (September 30, 1993); and completed within six months of this date. The operator has not followed the implementation schedule as specified in the GWQAP and Closure plan. This constitutes a violation of the requirements of rule 3745-65-93(D)(4) of the OAC for failing to follow the approved GWQAP.

Assessment Monitoring Sampling Events

Only two sampling events have occurred since the approval of the Amended Closure Plan (September 30, 1993). The first sampling event occurred on June 13, 1995. Results from this sampling event have not been submitted to the Ohio EPA. The second sampling event occurred on January 26, 1995. Again, the Ohio EPA has not received these results.

According to the GWQAP, ground water samples are to be collected quarterly. As of 01/26/95, the facility has not met the quarterly sampling frequency as required by rule 3745-65-93(D)(7) of the OAC.

Ground Water Quality Analytical Results

Ground water quality analytical results are presented in Table 3. Only the results from the June 28/July 6, 1989 sampling event are provided. 1,2-Dichloroethylene was detected in all three monitoring wells at concentrations ranging from 0.060 to 6.8 mg/l. Acetone was detected in monitoring well MW-3 at a concentration of 0.26 mg/l. Tetrachloroethylene was detected in monitoring wells MW-1 and MW-3 at concentrations of 5.0 and 0.44 mg/l, respectively. Trichloroethylene was detected in monitoring wells MW-1 and MW-3 at concentrations of 0.78 and 0.28 mg/l, respectively. Toluene was detected in monitoring well MW-1 at 0.58 mg/l. Lead was detected in only one monitoring well, MW-3, at a concentration of 0.018 mg/l.

As of January 27, 1995, the facility has not determined the full rate, extent, and concentration of hazardous waste and hazardous waste constituents in ground water associated with the RCRA unit as required by rule 3745-65-93(D)(4) of the OAC.

Table 3. Summary of Analytical Results (monitoring wells MW-1, MW-2, and MW-3)

Well Number	Sample Date	Volatile Organics (mg/l)		Total Lead (mg/l)
MW-1	06/28/89	DCE	6.800	ND
		PCE	5.000	
		TCE	0.780	
		TOL	0.580	
MW-2	06/28/89	DCE	0.060	ND
MW-3	07/06/89	ACE	0.260	0.018
		DCE	4.500	
		PCE	0.440	
		TCE	0.280	

ACE = Acetone
DCE = 1,2 -Dichloroethylene
PCE = Tetrachloroethylene
TCE = Trichloroethylene
TOL = Toluene

ND = denotes not detected

*** Analytical results from 06/13/94, and 01/26/95 sampling events have not been reported.

VII. RECORDKEEPING AND REPORTING REQUIREMENTS

Recordkeeping Requirements

In accordance with rule 3745-65-94 (B) (1), Vernitron Piezoelectric has kept records of the required evaluations and analytical results as specified in the Ground Water Quality Assessment Plan included in the approved Amended Closure Plan. These records were reviewed during the CME inspection (01/27/95).

Reporting Requirements

The facility has not filed an annual report for the assessment monitoring system for March 1, 1994 and March 1, 1995 as required by rule 3745-65-75 of the OAC.

VIII. COMPLIANCE STATUS SUMMARY

As a result of this CME, several violations of the Ohio interim status ground water monitoring regulations OAC rules 3745-65-90 through 3745-65-94 have been identified. Each violation is listed below, and a brief corresponding explanation of the nature of the violation is given. The attached RCRA checklists should be consulted for additional information.

Violations

Violation 1: OAC 3745-65-75

Vernitron Piezoelectric has failed to file an annual report for the assessment monitoring system for March 1, 1994 and March 1, 1995 as required by rule 3745-65-75 of the Ohio Administrative Code.

No Supplemental Annual Report Forms for Ground Water Monitoring data have been received during the compliance period under evaluation.

Violation 2: OAC 3745-65-91 (A) (1) (a) and (b)

Vernitron Piezoelectric Division has failed to show that ground water collected from the background well (MW-4) is representative of background water quality in the uppermost aquifer as required by rule 3745-65-91(A)(1)(a) of the Ohio Administrative Code. Analytical results for MW-4 have not been received by Ohio EPA.

Vernitron Piezoelectric Division has also failed to show that ground water collected from the background well (MW-4) has not been affected by the facility as specified in rule 3745-65-91(A)(1)(b) of the Ohio Administrative Code. Analytical results for MW-4 have not been received by Ohio EPA.

Upgradient well MW-4 was installed in January 1995. Although the well is hydraulically upgradient of the RCRA unit, data are not yet available to determine if samples collected from the well are representative of background water quality unaffected by the facility.

Violation 3: OAC 3745-65-93 (D)(4)

Vernitron Piezoelectric Division has failed to implement a ground water quality assessment program capable of determining: 1) the full rate and extent of migration of hazardous waste or hazardous waste constituents in the uppermost aquifer; and 2) the concentrations of the hazardous waste or hazardous waste constituents in the uppermost aquifer; as required by rule OAC 3745-65-93 (D) (4) of the Ohio Administrative Code.

The GWQAP was approved in September 1993 and implementation of the program should have been initiated within sixty days of the approval. The company did not initiate implementation of this plan until January 1995. The additional downgradient wells proposed in the plan have not been installed. Quarterly monitoring has not been completed during the compliance period under evaluation.

Violation 4: OAC 3745-65-93 (D) (7)

Vernitron Piezoelectric has failed to meet the quarterly sampling frequency as required by rule 3745-65-93 (D) (7) of the Ohio Administrative Code.

Quarterly sampling of the ground water monitoring wells was not initiated during the compliance period under consideration. Quarterly sampling of the wells should have commenced within 60 days of the formal approval of the closure plan by the Ohio EPA in September 1993.

Deficiencies

Deficiency 1:

During the CME inspection, the company did not follow proper decontamination procedures for sampling equipment. Although samples were collected for metals and VOC analyses, the decontamination procedures did not include a nitric acid rinse nor acetone and pesticide grade hexane rinses.

Deficiency 2:

During the CME inspection, the company did not take ground water temperature readings. In addition, the pH and specific conductivity readings are not reliable due to a malfunction of the measurement equipment.

Deficiency 3:

Sufficient ground water elevation data are not available to evaluate seasonal and temporal variations in ground water flow direction. The January 1995 water level elevation data indicate that the ground water flow direction may have changed since the water levels were last measured in 1994. Alternatively, a surveying error of the newly installed well risers may be responsible for the apparent shift in flow direction.

APPENDICES

APPENDIX A

COMPREHENSIVE GROUND-WATER MONITORING EVALUATION WORKSHEET

The following worksheets have been designed to assist the enforcement officer/ technical reviewer in evaluating the ground-water monitoring system an owner/operator uses to collect and analyze samples of ground water. The focus of the worksheets is technical adequacy as it relates to obtaining and analyzing representative samples of ground water. The basis of the worksheets is the final RCRA Ground Water Monitoring Technical Enforcement Guidance Document which describes in detail the aspects of ground-water monitoring which EPA deems essential to meet the goals of RCRA. Appendix A is not a regulatory checklist. Specific technical deficiencies in the monitoring system can, however, be related to the regulations as illustrated in Figure 4.3 taken from the RCRA Ground-Water Monitoring Compliance Order Guide (COG) (included at the end of the appendix). The enforcement officer, in developing an enforcement order, should relate the technical assessment from the worksheets to the regulations using Figure 4.3 from the COG as a guide.

Comprehensive Ground-Water Monitoring Evaluation	Y/N
I. Office Evaluation Technical Evaluation of the Design of the Ground-Water Monitoring System A. Review of Relevant Documents 1. What documents were obtained prior to conducting the inspection: a. RCRA Part A permit application?	N
b. RCRA Part B permit application?	N
c. Correspondence between the owner/operator and appropriate agencies or citizen's groups?	Y
d. Previously conducted facility inspection reports?	Y
e. Facility's contractor reports?	Y
f. Regional hydrogeologic, geologic, or soil reports?	Y
g. The facility's Sampling and Analysis Plan?	Y #1
h. Ground-water Assessment Program Outline (or Plan, if the facility is in assessment monitoring)?	Y
i. Other (specify) Geologic Reports	Y

Y = YES
N = NO
N/A = NOT APPLICABLE
N S = NOT SPECIFIED
* = COMMENT NUMBER

	Y/N
B. Evaluation of the Owner/Operator's Hydrogeologic Assessment	
1. Did the owner/operator use the following direct techniques in the hydrogeologic assessment:	
a. Logs of the soil borings/rock corings (documented by a professional geologist, soil scientist, or geotechnical engineer)?	Y
b. Materials tests (e.g., grain-size analyses, standard penetration tests, etc.)?	Y
c. Piezometer installation for water level measurements at different depths?	N #2
d. Slug tests?	N #3
e. Pump tests?	N
f. Geochemical analyses of soil samples?	Y
g. Other (specify) (e.g., hydrochemical diagrams and wash analysis)	N/A
2. Did the owner/operator use the following indirect techniques to supplement direct technique data:	
a. Geophysical well logs?	N
b. Tracer studies?	N
c. Resistivity and/or electromagnetic conductance?	N
d. Seismic Survey?	N
e. Hydraulic conductivity measurements of cores?	N
f. Aerial photography?	N
g. Ground penetrating radar?	N
h. Other (specify)	N
3. Did the owner/operator document and present the raw data from the site hydrogeologic assessment?	Y #1
4. Did the owner/operator document methods (criteria) used to correlate and analyze the information?	Y
5. Did the owner/operator prepare the following:	
a. Narrative description of geology?	Y
b. Geologic cross sections?	N
c. Geologic and soil maps?	Y
d. Boring/coring logs?	Y
e. Structure contour maps of the differing water bearing zone and confining layers?	N
f. Narrative description and calculation of ground-water flows?	Y

	Y/N
g. Water table/potentiometric map?	Y
h. Hydrologic cross sections?	Y
6. Did the owner/operator obtain a regional map of the area and delineate the facility?	Y
If yes, does this map illustrate: a. Surficial geology features?	Y
b. Streams, rivers, lakes, or wetlands near the facility?	Y
c. Discharging or recharging wells near the facility?	N
7. Did the owner/operator obtain a regional hydrogeologic map?	N
If yes, does this hydrogeologic map indicate: a. Major areas of recharge/discharge?	N
b. Regional ground-water flow direction?	N
c. Potentiometric contours which are consistent with observed water level elevations?	N
8. Did the owner/operator prepare a facility site map?	Y
If yes, does the site map show: a. Regulated units of the facility (e.g., landfill areas, impoundments)?	Y
b. Any seeps, springs, streams, ponds, or wetlands?	Y
c. Location of monitoring wells, soil borings, or test pits?	Y
d. How many regulated units does the facility have? 1	Y
If more than one regulated unit then, • Does the waste management area encompass all regulated units?	N/A
• Is a waste management area delineated for each regulated unit?	N/A
C. Characterization of Subsurface Geology of Site 1. Soil boring/test pit program:	
a. Were the soil borings/test pits performed under the supervision of a qualified professional?	Y
b. Did the owner/operator provide documentation for selecting the spacing for borings?	Y
c. Were the borings drilled to the depth of the first confining unit below the uppermost zone of saturation or ten feet into bedrock?	Y
d. Indicate the method(s) of drilling: Hollow Stem Augering / Split Spoon Sampling	Y

	Y/N	
Auger (hollow or solid stem) HS Mud rotary N/A Reverse rotary N/A Cable tool N/A Jetting N/A Other (specify) Geoprobe / Hydropunch technologies	Y	
e. Were continuous sample corings taken?	Y	
f. How were the samples obtained (check method[s]) • Split spoon X • Shelby tube, or similar X • Rock coring ____ • Ditch sampling ____ • Other (explain) ____		
g. Were the continuous sample corings logged by a qualified professional in geology?	Y	
h. Does the field boring log include the following information: • Hole name/number?	Y	
• Date started and finished?	Y	
• Driller's name?	N	#5
• Hole location (i.e., map and elevation)?	N	#6
• Drill rig type and bit/auger size?	N	#7
• Gross petrography (e.g., rock type) of each geologic unit?	Y	
• Gross mineralogy of each geologic unit?	N	#8
• Gross structural interpretation of each geologic unit and structural features (e.g., fractures, gouge material, solution channels, buried streams or valleys, identification of depositional material)?	N	#9
• Development of soil zones and vertical extent and description of soil type?	Y	
• Depth of water bearing unit(s) and vertical extent of each?	Y	
• Depth and reason for termination of borehole?	Y	
• Depth and location of any contaminant encountered in borehole?	N/A	
• Sample location/number?	Y	
• Percent sample recovery?	N	#10
• Narrative descriptions of: —Geologic observations?	Y	
—Drilling observations?	Y	
i. Were the following analytical tests performed on the core samples: • Mineralogy (e.g., microscopic tests and x-ray diffraction)?	N	
• Petrographic analysis: —degree of crystallinity and cementation of matrix?	N	
—degree of sorting, size fraction (i.e., sieving), textural variations?	N	
—rock type(s)?	N	

	Y/N
—soil type?	N
—approximate bulk geochemistry?	N
—existence of microstructures that may effect or indicate fluid flow?	N
• Falling head tests?	N
• Static head tests?	N
• Settling measurements?	N
• Centrifuge tests?	N
• Column drawings?	N
D. Verification of Subsurface Geological Data 1. Has the owner/operator used indirect geophysical methods to supplement geological conditions between borehole locations?	N
2. Do the number of borings and analytical data indicate that the confining layer displays a low enough permeability to impede the migration of contaminants to any stratigraphically lower water-bearing units?	N
3. Is the confining layer laterally continuous across the entire site?	N/S #11
4. Did the owner/operator consider the chemical compatibility of the site-specific waste types and the geologic materials of the confining layer?	N
5. Did the geologic assessment address or provide means for resolution of any information gaps of geologic data?	Y
6. Do the laboratory data corroborate the field data for petrography?	N/A
7. Do the laboratory data corroborate the field data for mineralogy and subsurface geochemistry?	N/A
E. Presentation of Geologic Data 1. Did the owner/operator present geologic cross sections of the site?	Y #12
2. Do cross sections: a. identify the types and characteristics of the geologic materials present?	Y
b. define the contact zones between different geologic materials?	Y
c. note the zones of high permeability or fracture?	N
d. give detailed borehole information including:	

	Y/N
• location of borehole?	N
• depth of termination?	N
• location of screen (if applicable)?	N
• depth of zone(s) of saturation?	Y
• backfill procedure?	N
3. Did the owner/operator provide a topographic map which was constructed by a licensed surveyor?	N
4. Does the topographic map provide:	
a. contours at a maximum interval of two-feet?	N/A
b. locations and illustrations of man-made features (e.g., parking lots, factory buildings, drainage ditches, storm drain, pipelines, etc.)?	N/A
c. descriptions of nearby water bodies?	N/A
d. descriptions of off-site wells?	N/A
e. site boundaries?	N/A
f. individual RCRA units?	N/A
g. delineation of the waste management area(s)?	N/A
h. well and boring locations?	N/A
5. Did the owner/operator provide an aerial photograph depicting the site and adjacent off-site features?	N
6. Does the photograph clearly show surface water bodies, adjacent municipalities, and residences and are these clearly labelled?	N/A
F. Identification of Ground-Water Flowpaths	
1. Ground-water flow direction	
a. Was the well casing height measured by a licensed surveyor to the nearest 0.01 foot?	Y
b. Were the well water level measurements taken within a 24 hour period?	Y
c. Were the well water level measurements taken to the nearest 0.01 foot?	Y
d. Were the well water levels allowed to stabilize after construction and development for a minimum of 24 hours prior to measurements?	Y
e. Was the water level information obtained from (check appropriate one): • multiple piezometers placed in single borehole? ____ • vertically nested piezometers in closely spaced separate boreholes? ____ • monitoring wells? X	

	Y/N
f. Did the owner/operator provide construction details for the piezometers?	N/A
g. How were the static water levels measured (check method[s]). • Electric water sounder X • Wetted tape ___ • Air line ___ • Other (explain) ___	
h. Was the well water level measured in wells with equivalent screened intervals at an equivalent depth below the saturated zone?	Y
i. Has the owner/operator provided a site water table (potentiometric) contour map?	Y
If yes, • Do the potentiometric contours appear logical and accurate based on topography and presented data? (Consult water level data)	Y
• Are ground-water flow-lines indicated?	Y
• Are static water levels shown?	Y
• Can hydraulic gradients be estimated?	Y
j. Did the owner/operator develop hydrologic cross sections of the vertical flow component across the site using measurements from all wells?	N
k. Do the owner/operator's flow nets include: • piezometer locations?	N/A
• depth of screening?	N/A
• width of screening?	N/A
• measurements of water levels from all wells and piezometers?	N/A
2. Seasonal and temporal fluctuations in ground-water a. Do fluctuations in static water levels occur? If yes, are the fluctuations caused by any of the following:	Y
—Off-site well pumping	N
—Tidal processes or other intermittent natural variations (e.g., river stage, etc.)	N
—On-site well pumping	N
—Off-site, on-site construction or changing land use patterns	N
—Deep well injection	N
—Seasonal variations	Y
—Other (specify) ___	
b. Has the owner/operator documented sources and patterns that contribute to or affect the ground-water patterns below the waste management area?	Y
c. Do water level fluctuations alter the general ground-water gradients and flow directions?	Y
d. Based on water level data, do any head differentials occur that may indicate a vertical flow component in the saturated zone?	Y

	Y/N	
e. Did the owner/operator implement means for gauging long term effects on water movement that may result from on-site or off-site construction or changes in land-use patterns?	N	
3. Hydraulic conductivity		
a. How were hydraulic conductivities of the subsurface materials determined?	N/A	#14
• Single-well tests (slug tests)?	N/A	
• Multiple-well tests (pump tests)	N	
• Other (specify) ________	N	
b. If single-well tests were conducted, were they done by: • Adding or removing a known volume of water?	N/A	
• Pressurizing well casing?	N/A	
c. If single well tests were conducted in a highly permeable formation, were pressure transducers and high-speed recording equipment used to record the rapidly changing water levels?	N/A	
d. Since single well tests only measure hydraulic conductivity in a limited area, were enough tests run to ensure a representative measure of conductivity in each hydrogeologic unit?	N/A	
e. Are the owner/operator's slug test data (if applicable) consistent with existing geologic information (e.g., boring logs)?	N/A	
f. Were other hydraulic conductivity properties determined?	N	
g. If yes, provide any of the following data, if available: • Transmissivity N/A • Storage coefficient N/A • Leakage N/A • Permeability N/A • Porosity N/A • Specific capacity N/A • Other (specify) ________		
4. Identification of the uppermost aquifer		
a. Has the extent of the uppermost saturated zone (aquifer) in the facility area been defined? If yes,	Y	
• Are soil boring/test pit logs included?	Y	
• Are geologic cross-sections included?	Y	#15
b. Is there evidence of confining (competent, unfractured, continuous, and low permeability) layers beneath the site? If yes,	Y	
• how was continuity demonstrated? See Comment		#16
c. What is the hydraulic conductivity of the confining unit? (cm/sec.	N/A	
d. How was it determined?	N/A	

	Y/N
e. Does potential for other hydraulic communication exist (e.g., lateral discontinuity between geologic units, facies changes, fracture zones, cross cutting structures, or chemical corrosion/alteration of geologic units by leachate)? If yes or no, what is the rationale? The glacial till which ~~to~~ appears to be confining in nature, may not be laterally continuous in all directions. Fractures may exist in bedrock, + could extend upward into the glacial materials	Y
G. Office Evaluation of the Facility's Ground-Water Monitoring System—Monitoring Well Design and Construction: These questions should be answered for each different well design present at the facility. 1. Drilling Methods a. What drilling method was used for the well? • Hollow-stem auger ☒ • Solid-stem auger ☐ • Mud rotary (water) ☐ • Air rotary ☐ • Reverse rotary ☐ • Cable tool ☐ • Jetting ☐ • Air drill w/ casing hammer ☐ • Other (specify) ______	
b. Were any cutting fluids (including water) or additives used during drilling? If yes, specify: • Type of drilling fluid N/A • Source of water used N/A • Foam N/A • Polymers N/A • Other N/A	N
c. Was the cutting fluid, or additive, identified?	N/A
d. Was the drilling equipment steam-cleaned prior to drilling the well? • Other methods ______	Y
e. Was compressed air used during drilling? If yes, • was the air filtered to remove oil?	N
f. Did the owner/operator document procedure for establishing the potentiometric surface? If yes, • how was the location established?	Y
g. Formation samples	Y

#

	Y/N
• Were formation samples collected initially during drilling?	Y
• Were any cores taken continuously ?	Y
• If not, at what interval were samples taken?	NA
• How were the samples obtained? X Split spoon —Shelby tube —Core drill —Other (specify)	
• Identify if any physical and/or chemical tests were performed on the formation samples (specify) Soil and ground water Samples were Collected for Chemical analysis	
2. Monitoring Well Construction Materials a. Identify construction materials (by number) and diameters (ID/OD) Material / Diameter • Primary Casing: PVC / 4" • Secondary or outside casing (double construction): Steel / 8" • Screen: PVC / 4"	
b. How are the sections of casing and screen connected? • Pipe sections threaded	Y
• Couplings (friction) with adhesive or solvent	N
• Couplings (friction) with retainer screws	N
• Other (specify)	N
c. Were the materials steam-cleaned prior to installation? • If no, how were the materials cleaned? Factory Sealed	N
3. Well Intake Design and Well Development a. Was a well intake screen installed?	Y
• What is the length of the screen for the well? 5 - 10 feet	
• Is the screen manufactured?	Y
b. Was a filter pack installed?	Y
• What kind of filter pack was employed? Clean Silica Sand	
• Is the filter pack compatible with formation materials?	Y
• How was the filter pack installed? through Hollow-Stem augers as they were pulled	

	Y/N
• What are the dimensions of the filter pack? diameter of annulus - installed a min of 1 feet above screen	
• Has a turbidity measurement of the well water ever been made?	N
• Have the filter pack and screen been designed for the in-situ materials?	Y
c. Well development • Was the well developed?	Y
• What technique was used for well development? —Surge block X Bailer —Air surging X Water pumping —Other (specify) ______	
4. Annular Space Seals a. What is the annular space in the saturated zone directly above the filter pack filled with: X Sodium bentonite (specify type and grit) —Cement (specify neat or concrete) —Other (specify)	3/8" pellets
b. Was the seal installed by: —Dropping material down the hole and tamping X Dropping material down the inside of hollow-stem auger —Tremie pipe method —Other (specify)	
c. Was a different seal used in the unsaturated zone? If yes,	Y
• Was this seal made with? X Sodium bentonite (specify type and grit) X Cement (specify neat or concrete)- Other (specify)	
• Was this seal installed by? —Dropping material down the hole and tamping X Dropping material down the inside of hollow stem auger —Other (specify)	
d. Is the upper portion of the borehole sealed with a concrete cap to prevent infiltration from the surface?	Y
e. Is the well fitted with an above-ground protective device and bumper guards?	Y
f. Has the protective cover been installed with locks to prevent tampering?	Y

H 1

	Y/N
H. Evaluation of the Facility's Detection Monitoring Program	
1. Placement of Downgradient Detection Monitoring Wells	
a. Are the ground-water monitoring wells or clusters located immediately adjacent to the waste management area?	Y
b. How far apart are the detection monitoring wells? 100 ~ 200'	
c. Does the owner/operator provide a rationale for the location of each monitoring well or cluster?	Y
d. Does the owner/operator identify the well screen lengths of each monitoring well or cluster?	Y
e. Does the owner/operator provide an explanation for the well screen lengths of each monitoring well or cluster?	Y
f. Do the actual locations of monitoring wells or clusters correspond to those identified by the owner/operator?	Y
2. Placement of Upgradient Monitoring Wells	
a. Has the owner/operator documented the location of each upgradient monitoring well or cluster?	Y
b. Does the owner/operator provide an explanation for the location(s) of the upgradient monitoring wells?	Y
c. What length screen has the owner/operator employed in the background monitoring well(s)?	5'
d. Does the owner/operator provide an explanation for the screen length(s) chosen?	Y
e. Does the actual location of each background monitoring well or cluster correspond to that identified by the owner/operator?	Y
I. Office Evaluation of the Facility's Assessment Monitoring Program	
1. Does the assessment plan specify:	
a. The number, location, and depth of wells?	Y
b. The rationale for their placement and identify the basis that will be used to select subsequent sampling locations and depths in later assessment phases?	Y
2. Does the list of monitoring parameters include all hazardous waste constituents from the facility?	Y

#2c

	Y/N
a. Does the water quality parameter list include other important indicators not classified as hazardous waste constituents?	N
b. Does the owner/operator provide documentation for the listed wastes which are not included?	N/A
3. Does the owner/operator's assessment plan specify the procedures to be used to determine the rate of constituent migration in the ground-water?	Y
4. Has the owner/operator specified a schedule of implementation in the assessment plan?	Y #21
5. Have the assessment monitoring objectives been clearly defined in the assessment plan?	Y
a. Does the plan include analysis and/or re-evaluation to determine if significant contamination has occurred in any of the detection monitoring wells?	Y
b. Does the plan provide for a comprehensive program of investigation to fully characterize the rate and extent of contaminant migration from the facility?	Y
c. Does the plan call for determining the concentrations of hazardous wastes and hazardous waste constituents in the ground water?	Y
d. Does the plan employ a quarterly monitoring program?	Y
6. Does the assessment plan identify the investigatory methods that will be used in the assessment phase?	Y
a. Is the role of each method in the evaluation fully described?	Y
b. Does the plan provide sufficient descriptions of the direct methods to be used?	Y
c. Does the plan provide sufficient descriptions of the indirect methods to be used?	N/A
d. Will the method contribute to the further characterization of the contaminant movement?	Y
7. Are the investigatory techniques utilized in the assessment program based on direct methods?	Y
a. Does the assessment approach incorporate indirect methods to further support direct methods?	N/A
b. Will the planned methods called for in the assessment approach ultimately meet performance standards for assessment monitoring?	Y
c. Are the procedures well defined?	Y
d. Does the approach provide for monitoring wells similar in design and construction as the detection monitoring wells?	Y

	Y/N
e. Does the approach employ taking samples during drilling or collecting core samples for further analysis?	Y
8. Are the indirect methods to be used based on reliable and accepted geophysical techniques?	N/A
a. Are they capable of detecting subsurface changes resulting from contaminant migration at the site?	N/A
b. Is the measurement at an appropriate level of sensitivity to detect ground-water quality changes at the site?	N/A
c. Is the method appropriate considering the nature of the subsurface materials?	N/A
d. Does the approach consider the limitations of these methods?	N/A
e. Will the extent of contamination and constituent concentration be based on direct methods and sound engineering judgment? (Using indirect methods to substantiate the findings.)	Y
9. Does the assessment approach incorporate any mathematical modeling to predict contaminant movement?	N/A
a. Will site specific measurements be utilized to accurately portray the subsurface?	Y
b. Will the derived data be reliable?	Y
c. Have the assumptions been identified?	Y
d. Have the physical and chemical properties of the site specific wastes and hazardous waste constituents been identified?	Y
J. Conclusions	
1. Subsurface geology	
a. Have sufficient data been collected to adequately define petrography and petrographic variation?	Y
b. Has the subsurface geochemistry been adequately defined?	Y
c. Was the boring/coring program adequate to define subsurface geologic variation?	Y
d. Was the owner/operator's narrative description complete and accurate in its interpretation of the data?	Y
e. Does the geologic assessment address or provide means to resolve any information gaps?	Y
2. Ground-water flowpaths	
a. Did the owner/operator adequately establish the horizontal and vertical components of ground water flow?	N

#2.

	Y/N	
b. Were appropriate methods used to establish ground-water flowpaths?	Y	
c. Did the owner/operator provide accurate documentation?	Y	
d. Are the potentiometric surface measurements valid?	Y	22a
e. Did the owner/operator adequately consider the seasonal and temporal effects on the ground-water?	N	
f. Were sufficient hydraulic conductivity tests performed to document lateral and vertical variation in hydraulic conductivety in the entire hydrogeologic subsurface below the site?	N/A	#23
3. Uppermost Aquifer a. Did the owner/operator adequately define the upper-most aquifer?	Y	
4. Monitoring Well Construction and Design a. Do the design and construction of the owner/operator's ground-water monitoring wells permit depth discrete ground-water samples to be taken?	Y	
b. Are the samples representative of ground-water quality?	Y	
c. Are the ground-water monitoring wells structurally stable?	Y	
d. Does the ground-water monitoring well's design and construction permit an accurate assessment of aquifer characteristics?	Y	
5. Detection Monitoring a. Downgradient Wells • Do the location, and screen lengths of the ground-water monitoring wells or clusters in the detection monitoring system allow the immediate detection of a release of hazardous waste or constituents from the hazardous waste management area to the uppermost aquifer?	Y	
b. Upgradient Wells • Do the location and screen lengths of the upgradient (background) ground-water monitoring wells ensure the capability of collecting ground-water samples representative of upgradient (background) ground-water quality including any ambient heterogenous chemical characteristics?	Y	
6. Assessment Monitoring a. Has the owner/operator adequately characterized site hydrogeology to determine contaminant migration?	Y	#2
b. Is the detection monitoring system adequately designed and constructed to immediately detect any contaminant release?	Y	

	Y/N
c. Are the procedures used to make a first determination of contamination adequate?	Y
d. Is the assessment plan adequate to detect, characterize, and track contaminant migration?	Y
e. Will the assessment monitoring wells, given site hydrogeologic conditions, define the extent and concentration of contamination in the horizontal and vertical planes?	Y
f. Are the assessment monitoring wells adequately designed and constructed?	Y
g. Are the sampling and analysis procedures adequate to provide a true measurement of contamination?	Y
h. Do the procedures used for evaluation of assessment monitoring data result in determinations of the rate of migration, extent of migration, and hazardous constituent composition of the contaminant plume?	Y
i. Are the data collected at sufficient frequency and duration to adequately determine the rate of migration?	N #26
j. Is the schedule of implementation adequate?	Y
k. Is the owner/operator's assessment monitoring plan adequate?	Y
• If the owner/operator had to implement his assessment monitoring plan was it implemented satisfactorily?	N #27
II. Field Evaluation	
A. Ground-Water Monitoring System	
1. Are the numbers, depths, and locations of monitoring wells in agreement with those reported in the facility's monitoring plan? (See Section 3.2.3.)	Y
B. Monitoring Well Construction	
1. Identify construction material material diameter a. Primary Casing PVC / 4" I.D b. Secondary or outside casing Steel Protective casing 8" I.D.	
2. Is the upper portion of the borehole sealed with concrete to prevent infiltration from the surface?	Y
3. Is the well fitted with an above-ground protective device?	Y
4. Is the protective cover fitted with locks to prevent tampering? If a facility utilizes more than a single well design, answer the above questions for each well design?	Y

	Y/N
III. Review of Sample Collection Procedures	
A. Measurement of Well Depths /Elevation	
1. Are measurements of both depth to standing water and depth to the bottom of the well made?	Y
2. Are measurements taken to the 0.01 foot?	Y
3. What device is used?	Steel tape
4. Is there a reference point established by a licensed surveyor?	Y
5. Is the measuring equipment properly cleaned between well locations to prevent cross contamination?	Y
B. Detection of Immiscible Layers	
1. Are procedures used which will detect light phase immiscible layers?	Y
2. Are procedures used which will detect heavy phase immiscible layers?	N
C. Sampling of Immiscible Layers	
1. Are the immiscible layers sampled separately prior to well evacuation?	N/A #21
2. Do the procedures used minimize mixing with water soluble phases?	Y
D. Well Evacuation	
1. Are low yielding wells evacuated to dryness?	Y
2. Are high yielding wells evacuated so that at least three casing volumes are removed?	Y
3. What device is used to evacuate the wells? Well bailer + grundfos pump	
4. If any problems are encountered (e.g., equipment malfunction) are they noted in a field logbook?	Y

	Y/N	
Sample Withdrawal		
1. For low yielding wells, are samples for volatiles, pH, and oxidation/reduction potential drawn first after the well recovers?	Y	
2. Are samples withdrawn with either flurocarbon/resins or stainless steel (316, 304 or 2205) sampling devices?	Y	#29
3. Are sampling devices either bottom valve bailers or positive gas displacement bladder pumps?	Y	
4. If bailers are used, is fluorocarbon/resin coated wire, single strand stainless steel wire, or monofilament used to raise and lower the bailer?	Y	
5. If bladder pumps are used, are they operated in a continuous manner to prevent aeration of the sample?	Y	
6. If bailers are used, are they lowered slowly to prevent degassing of the water?	Y	
7. If bailers are used, are the contents transferred to the sample container in a way that minimizes agitation and aeration?	Y	
8. Is care taken to avoid placing clean sampling equipment on the ground or other contaminated surfaces prior to insertion into the well?	Y	
9. If dedicated sampling equipment is not used, is equipment disassembled and thoroughly cleaned between samples?	Y	
10. If samples are for inorganic analysis, does the cleaning procedure include the following sequential steps: a. Nonphosphate detergent wash? b. Dilute acid rinse (HNO_3 or HCl)? c. Tap water rinse? d. Type II reagent grade water?	a) Y b) N c) Y d) Y	#30
11. If samples are for organic analysis, does the cleaning procedure include the following sequential steps: a. Nonphosphate detergent wash?	Y	#31
b. Tap water rinse?	Y	
c. Distilled/deionized water rinse?	Y	
d. Acetone rinse?	N	
e. Pesticide-grade hexane rinse?	N	

	Y/N
12. Is sampling equipment thoroughly dry before use?	Y
13. Are equipment blanks taken to ensure that sample cross-contamination has not occurred?	Y
14. If volatile samples are taken with a positive gas displacement bladder pump, are pumping rates below 100 ml/min?	Y
F. In-situ or Field Analyses	
1. Are the following labile (chemically unstable) parameters determined in the field:	
a. pH?	Y
b. Temperature?	N
c. Specific conductivity?	N
d. Redox potential?	N
e. Chlorine?	N
f. Dissolved oxygen?	N
g. Turbidity?	N
h. Other (specify) ______________________	N
2. For in-situ determinations, are they made after well evacuation and sample removal?	Y
3. If sample is withdrawn from the well, is parameter measured from a split portion?	Y
4. Are monitoring equipment calibrated according to manufacturer's specifications and consistent with SW-846?	Y
5. Are the date, procedure, and maintenance for equipment calibration documented in the field logbook?	Y
IV. Review of Sample Preservation and Handling Procedures	
A. Sample Containers	
1. Are samples transferred from the sampling device directly to their compatible containers?	Y

32

	Y/N
2. Are sample containers for metals (inorganics) analyses polyethylene with polypropylene caps?	Y
3. Are sample containers for organics analysis glass bottles with fluorocarbonresin-lined caps?	Y
4. If glass bottles are used for metals samples are the caps fluorocarbonresin-lined?	N/A
5. Are the sample containers for metal analyses cleaned using these sequential steps:	
a. Nonphosphate detergent wash?	N/A
b. 1:1 nitric acid rinse?	N/A
c. Tap water rinse?	N/A
d. 1:1 hydrochloric acid rinse?	N/A
e. Tap water rinse?	N/A
f. Distilled/deionized water rinse?	N/A
6. Are the sample containers for organic analyses cleaned using these sequential steps:	
a. Nonphosphate detergent/hot water wash?	N/A
b. Tap water rinse?	N/A
c. Distilled/deionized water rinse?	N/A
d. Acetone rinse?	N/A
e. Pesticide-grade hexane rinse?	N/A
7. Are trip blanks used for each sample container type to verify cleanliness?	Y
B. Sample Preservation Procedures	
1. Are samples for the following analyses cooled to 4°C:	
a. TOC?	N/A
b. TOX?	N/A
c. Chloride?	N/A
d. Phenols?	N/A
e. Sulfate?	N/A
f. Nitrate?	N/A
g. Coliform bacteria?	N/A
h. Cyanide?	N/A
i. Oil and grease?	N/A
j. Hazardous constituents (261, Appendix VIII)	Y

#33

	Y/N
2. Are samples for the following analyses field acidified to pH <2 with HNO_3:	
a. Iron?	N/A
b. Manganese?	N/A
c. Sodium?	N/A
d. Total metals?	NA
e. Dissolved metals? LEAD ONLY	Y
f. Fluoride?	N/A
g. Endrin?	N/A
h. Lindane?	N/A
i. Methoxychlor?	N/A
j. Toxaphene?	N/A
k. 2,4, D?	N/A
l. 2,4,5 TP Silvex?	N/A
m. Radium?	N/A
n. Gross alpha?	N/A
o. Gross beta?	N/A
3. Are samples for the following analyses field acidified to pH <2 with H_2SO_4: a. Phenols?	N/A
b. Oil and grease?	N/A
4. Is the sample for TOC analysis field acidified to pH <2 with HCl?	N/A
5. Is the sample for TOX analysis preserved with 1 ml of 1.1 M sodium sulfite?	N/A
6. Is the sample for cyanide analysis preserved with NaOH to pH >12?	N/A
C. Special Handling Considerations	
1. Are organic samples handled without filtering?	Y
2. Are samples for volatile organics transfered to the appropriate vials to eliminate headspace over the sample?	Y
3. Are samples for metal analysis split into two portions?	N/A
4. Is the sample for dissolved metals filtered through a 0.45 micron filter?	Y
5. Is the second portion not filtered and analyzed for total metals?	N/A
6. Is one equipment blank prepared each day of ground-water sampling?	Y

	Y/N
V. Review of Chain-of-Custody Procedures	
A. Sample Labels	
1. Are sample labels used?	Y
2. Do they provide the following information:	
a. Sample identification number?	Y
b. Name of collector?	Y
c. Date and time of collection?	Y
d. Place of collection?	Y
e. Parameter(s) requested and preservatives used?	Y
3. Do they remain legible even if wet?	Y
B. Sample Seals	
1. Are sample seals placed on those containers to ensure samples are not altered?	Y
C. Field Logbook	
1. Is a field logbook maintained?	Y
2. Does it document the following:	
a. Purpose of sampling (e.g., detection or assessment)?	Y
b. Location of well(s)?	Y
c. Total depth of each well?	Y
d. Static water level depth and measurement technique?	Y
e. Presence of immiscible layers and detection method?	Y
f. Collection method for immiscible layers and sample identification numbers?	Y
g. Well evacuation procedures?	Y
h. Sample withdrawal procedure?	Y
i. Date and time of collection?	Y
j. Well sampling sequence?	Y
k. Types of sample containers and sample identification number(s)?	Y
l. Preservative(s) used?	Y
m. Parameters requested?	Y
n. Field analysis data and method(s)?	Y
o. Sample distribution and transporter?	Y
p. Field observations?	Y

	Y/N
—Unusual well recharge rates?	Y
—Equipment malfunction(s)?	Y
—Possible sample contamination?	Y
—Sampling rate?	Y
D. Chain-of-Custody Record 1. Is a chain-of-custody record included with each sample?	Y
2. Does it document the following: a. Sample number?	Y
b. Signature of collector?	Y
c. Date and time of collection?	Y
d. Sample type?	Y
e. Station location?	Y
f. Number of containers?	Y
g. Parameters requested?	Y
h. Signatures of persons involved in chain-of-custody?	Y
i. Inclusive dates of custody?	Y
E. Sample Analysis Request Sheet 1. Does a sample analysis request sheet accompany each sample?	Y
2. Does the request sheet document the following: a. Name of person receiving the sample?	Y
b. Date of sample receipt?	Y
c. Duplicates?	Y
d. Analysis to be performed?	Y
VI. Review of Quality Assurance/Quality Control A. Is the validity and reliability of the laboratory and field generated data ensured by a QA/QC program?	Y
B. Does the QA/QC program include: 1. Documentation of any deviation from approved procedures?	Y

#35

#36

	Y/N
2. Documentation of analytical results for: a. Blanks?	Y
b. Standards?	Y
c. Duplicates?	Y
d. Spiked samples?	Y
e. Detectable limits for each parameter being analyzed?	Y
C. Are approved statistical methods used?	N/A
D. Are QC samples used to correct data?	N
E. Is all data critically examined to ensure it has been properly calculated and reported?	Y
VII. Surficial Well Inspection and Field Observation A. Are the wells adequately maintained?	Y
B. Are the monitoring wells protected and secure?	Y
C. Do the wells have surveyed casing elevations?	Y
D. Are the ground-water samples turbid?	Y
E. Have all physical characteristics of the site been noted in the inspector's field notes (i.e., surface waters, topography, surface features)?	Y
F. Has a site sketch been prepared by the field inspector with scale, north arrow, location(s) of buildings, location(s) of regulated units, locations of monitoring wells, and a rough depiction of the site drainage pattern?	Y

	Y/N
VIII. Conclusions	
A. Is the facility currently operating under the correct monitoring program according to the statistical analyses performed by the current operator?	Y #3
B. Does the ground-water monitoring system, as designed and operated, allow for detection or assessment of any possible ground-water contamination caused by the facility?	N #3
C. Does the sampling and analysis procedure permit the owner/operator to detect and, where possible, assess the nature and extent of a release of hazardous constituents to ground water from the monitored hazardous waste management facility?	Y

COMMENTS - APPENDIX A

1. Elements of the facility's Sampling and Analysis Plan are incorporated into the Ground Water Assessment Plan located in the approved Amended Closure Plan.

2. The installation of one or more deep bedrock wells and performance of assorted Berea Aquifer tests are being postponed until the horizontal and vertical extent of ground water contamination in the uppermost aquifer is fully defined. At that time, Vernitron will submit a revision to the Ground Water Quality Assessment Plan portion of the approved Amended Closure Plan detailing:

   a) results of the investigation to determine the horizontal and vertical extent of contamination in the upper aquifer, and;

   b) a proposal for assessing the impact of the RCRA unit, if any, and the quality of the Berea bedrock aquifer.

3. Slug tests will be conducted at the site as a part of the Ground Water Assessment. At the time of the CME inspection, monitoring wells #5, #6, and #7 were not completed.

4. Analytical results for ground water sampled in monitoring wells #1, #2, and #3 have been documented and presented in the closure plan. Subsequent sampling analytical data has not been submitted by the facility.

5. This information is asked for in the consultant's field documentation forms, however, only blank forms were provided in the approved Amended Closure Plan (Appendix B). Only the subcontractor's drilling logs were available at the time of this review.

6. see comment #5 above.

7. see comment #5 above.

8. see comment #5 above.

9. see comment #5 above.

10. see comment #5 above.

11. Not enough information is provided.

12. A generalized cross-section was provided.

13. Ground water appears to be under confining pressure. Water levels in each well rose several

feet after the borings were terminated and the wells installed.

14. Slug tests will be performed upon the installation and completion of all proposed monitoring wells in order to determine hydraulic conductivity and other hydrogeologic parameters.

15. A generalized cross-section is provided in the approved Closure Plan.

16. Water levels rose in each monitoring well to 3 to 5 feet above the top of the screened interval.

17. The potentiometric surface of the upper most aquifer was determined by surveying the top of casing and ground surface at each monitoring well, and using the water levels from each well to determine relative elevations based on an on-site datum of 100.00 ft.

18. A bentonite-cement slurry was used to grout the remaining well annulus, from the well seal to the ground surface.

20. The facility is sampling for parameters specified in the approved Amended Closure Plan.

21. The schedule of implementation is provided in the approved Amended Closure Plan.

22. The facility has not established vertical components of ground water flow at this time. Sufficient water level elevation data are not available to determine seasonal and temporal variations in ground water flow directions.

22a. The most recently collected water level elevation data may not be valid. The data indicate a shift in ground water flow direction. However, it is unclear at this time whether this apparent change in ground water flow direction is the result of seasonal or temporal variations in flow or to an error in surveying the recently installed well risers.

23. In-situ hydraulic conductivity testing will be conducted at the site as a part of the Ground Water Assessment program. At the time of the inspection, proposed monitoring wells #5, #6, and #7 were not completed.

25. The facility is taking a phased approach to determine rate and extent of ground water contamination as described in the approved Amended Closure Plan.

26. The most recent analytical data is provided in the approved Amended Closure Plan. These data are several years old. Recent sampling data has not been provided to the Ohio EPA. The company has not completed quarterly ground water sampling as required by OAC 3745-65-93 (D)(7).

27. According the approved Amended Closure Plan (approved September 20, 1993), monitoring well installation should have been completed within six months of the plan approval date.

28. No light phase immiscible layers have been found to date.

29. Teflon bailers with bottom spigots are used to withdraw the ground water sample from the monitoring well.

30. Non-phosphate detergent wash, rinse water, and type II reagent grade water is used (in that order) to decontaminate all sampling equipment.

31. See comment #30.

32. pH / Conductivity readings are not reliable due to equipment malfunction in the field. Also, ground water temperature readings were not taken.

33. All sample bottles were laboratory certified clean before use. No cleaning was necessary.

34. see comment #33.

35. Chain-of-Custody documentation is included with each sample cooler being sent to the laboratory.

36. Request for Analyses documentation accompanied each sample cooler to the laboratory.

37. The facility has affected ground water quality and is currently in assessment monitoring.

38. The number and location of wells are not adequate to allow for the detection or assessment of any possible ground water contamination caused by the facility.

APPENDIX A-1

FACILITY INSPECTION FORM FOR COMPLIANCE WITH INTERIM STATUS STANDARDS COVERING GROUND-WATER

Company: Vernitron Piezoelectric Division EPA I.D. Number: OHD 052 324 290

Company Address: 232 Forbes Road, Bedford, OHIO

Company Contact/Official: Mr. Kenneth Kupcak Title: Manager

Date of Inspection: 01/27/95

Inspector's Name: Todd R. Fisher Branch/Organization: OHIO EPA NEDO/DDAGW

Type of Facility: (check appropriately)	Y/N
a) surface impoundment	N
b) landfill	N
c) land treatment facility	N
Ground Water Monitoring Program	
1. Has a ground water monitoring plan been submitted to the Director for facilities containing a surface impoundment, landfill, land treatment facility?	Y
2. Was the ground water monitoring plan reviewed prior to the site visit? If "No," explain.	Y
A. Was the ground water plan reviewed at the facility prior to the actual site inspection? If "No," explain.	Y
3. Has a ground water monitoring program (capable of determining the facility's impact on the quality of ground water in the uppermost aquifer underlying the facility) been implemented? 3745-65-90(A)	Y
4. Has at least one monitoring well been installed in the uppermost aquifer hydraulically upgradient from the limit of the waste management area? 3745-65-91(A)(1)	Y
A. Are sufficient ground water samples from the uppermost aquifer, representative of background ground water quality and not affected by the facility, ensured by proper well	
1) Number(s)?	Y
2) Location?	Y
3) Depth?	Y

*1

Y - YES, N - NO, NA - NOT APPLICABLE
NS - NOT SPECIFIED, * - COMMENT

APPENDIX A-1	Y/N	
5. Have at least three monitoring wells been installed hydraulically downgradient at the limit of the waste handling or management area? 3745-65-91(A)(2)	Y	*2
6. Have the locations of the waste handling, storage, or disposal areas been verified to conform with information in the ground water monitoring plan?	Y	
7. Do the numbers, locations, and depths of the ground water monitoring wells agree with the data in the ground water monitoring system program? If "No," explain discrepancies.		
8. Have all monitoring wells been cased in a manner that: A. Maintains the integrity of the bore hole?	Y	
B. Is screened and packed to enable sample collection at depths where appropriate aquifer flow exists?	Y	
C. Prevents contamination of samples and ground water by sealing the annular space above the sampling depth with a suitable material? 3745-65-91(C)	Y	
9. Has a ground water sampling and analysis plan been developed? 3745-65-92(A)	Y	
A. Has it been followed?	Y	
B. Is the plan kept at the facility?	Y	
C. Does the plan include procedures and techniques for: 1) Measuring ground water elevations? 3745-65-92(A)(1)	Y	
2) Detection of immiscible layers, where applicable? 3745-65-92(A)(2)	Y	
3) Collecting ground water samples including? 3745-65-92(A)(3) a) Well evacuation? 3745-65-92(A)(3)(a)	Y	
b) Sample withdrawal? 3745-65-92(A)(3)(b)	Y	
c) Sample equipment? 3745-65-92(A)(3)(c)	Y	
d) Sample containers and handling? 3745-65-92(A)(3)(d)	Y	
e) Sample preservation? 3745-65-92(A)(3)(e)	Y	
4) Performing field analysis, including: a) Procedures and forms for recording raw data and the exact location, time, and facility specific considerations associated with the data acquisitions? 3745-65-92(A)(4)(a)	Y	
b) Calibration of field instruments? 3745-65-92(A)(4)(b)	Y	
c) Procedures for sample filtration? 3745-65-92(A)(4)(c)	Y	
5) Decontamination of equipment? 3745-65-92(A)(5)	Y	
6) Disposal of purge water? 3745-65-92(A)(6)	Y	

Y - YES, N - NO, NA - NOT APPLICABLE
NS - NOT SPECIFIED, * - COMMENT

APPENDIX A-1	Y/N
7) Ground water sample analysis of all applicable constituents associated with the facility including: 3745-65-92(A)(7) a) Constituents? 3745-65-92(A)(7)(a)	Y
b) Analytical method and detection limit? 3745-65-92(A)(7)(b)	Y
c) Sample holding time? 3745-65-92(A)(7)(c)	Y
8) Quality assurance/quality control: a) Samples for field/lab/equipment blanks? 3745-65-92(A)(8)(a)	Y
b) Duplicate samples? 3745-65-92(A)(8)(b)	Y
c) Potential interferences? 3745-65-92(A)(8)(c)	Y
9) Chain of custody procedures: a) Standardized field tracking reporting forms to establish sample custody for the field prior to and during shipping? 3745-65-92(A)(9)(a)	Y
b) Sample labels containing all information necessary for effective sample tracking? 3745-65-92(A)(9)(b)	Y
10. Have the required parameters in ground water samples been tested quarterly for the first year? 3745-65-92(B) and (C)(1)	N
A. Are the ground water samples analyzed for the following: 1) Parameters characterizing the suitability of the ground water as a drinking supply? 3745-65-92 B(1)	N
2) Parameters establishing ground water quality? 3745-65-92 B(2)	N
3) Parameters used as indicators of ground water contamination? 3745-65-92 B(3)	N
a) Are at least four replicate measurements obtained for each sample? 3745-65-92(C)(2)	N/A
b) Are provisions made to calculate the initial background arithmetic mean and variance of the respective parameter concentrations or values obtained from well(s) during the first year? 3745-65-92(C)(2)	N/A
B. For facilities which have complied with first year ground water sampling and analysis requirements: 1) Have samples been obtained and analyzed for the indicators of ground water quality at least annually? 3745-65-92(D)(1)	N/A
2) Have samples been obtained and analyzed for the indicators of ground water contamination at least semi-annually? 3745-65-92(D)(2)	N/A
C. Were ground water surface elevations determined at each monitoring well each time a sample was taken? 3745-65-92(E)	Y

*3

Y = YES, N = NO, NA = NOT APPLICABLE
NS = NOT SPECIFIED, * = COMMENT

APPENDIX A-1	Y/N	
D. Were the ground water surface elevations evaluated to determine whether the monitoring wells are properly placed? 3745-65-93(F)	Y	
E. If it was determined that modification of the number, location or depth of monitoring wells was necessary, was the system brought into compliance with 3745-65-91(A)? 3745-65-93(F)	N/A	
11. Has an outline of a ground water quality assessment program been prepared? 3745-65-93(A)	N/A	#4
A. Does it describe a program capable of determining: 1) Whether hazardous waste or hazardous waste constituents have entered the ground water? 3745-65-93(A)(1)		
2) The rate and extent of migration of hazardous waste or hazardous waste constituents? 3745-65-93(A)(2)	N/A	
3) Concentrations of hazardous waste or hazardous waste constituents in ground water? 3745-65-93(A)(3)	N/A	
B. Have at least four replicate measurements of each indicator parameter been obtained for samples taken for each well? 3745-65-93(B)	N/A	
1) Were the results compared with the initial background mean?	N/A	
a) Was each well considered individually?	N/A	
b) Was the Student's t-test used (at the 0.01 level of significance)?	N/A	
2) Was a significant increase (or pH decrease) found in the: a) Upgradient wells?	N/A	
b) Downgradient wells?	N/A	
If "Yes," Compliance Checklist A-2 must also be completed.	N/A	
12. Have records been kept of analyses for parameters establishing ground water quality and indicators of ground water contamination? 3745-65-94(A)(1)	N/A	
13. Have records been kept of ground water surface elevations taken at the time of sampling for each well? 3745-65-94(A)(1)	Y	
14. Have the following been submitted to the Director: 3745-65-94(A)(2) A. Initial background concentrations of parameters listed in 3745-65-92(B)(1) within 15 days after completing each quarterly analysis required during the first year? 3745-65-94(A)(2)(a)	N/A	
B. For each well, any parameters whose concentrations or values have exceeded the maximum contaminant levels allowed in drinking water supplies? 3745-65-94(A)(2)(a)	N/A	
C. Annual reports including: 3745-65-94(A)(2)(b) 1) Concentrations or values of parameters used as indicators of ground water contamination for each well?	N	*5

Y - YES, N - NO, NA - NOT APPLICABLE
NS - NOT SPECIFIED, * - COMMENT

APPENDIX A-1	Y/N
2) Separate identification of any significant differences from initial background found in upgradient wells? 3745-65-94(A)(2)(b)	N/A
3) Results of the evaluation of ground water surface elevations?	Y
4) Was the Annual Report submitted by March 1 of the following year? 3745-65-75(F)	N

Y = YES, N = NO, NA = NOT APPLICABLE
NS = NOT SPECIFIED, * = COMMENT

COMMENTS APPENDIX A-1

1. Upgradient well MW-4 was installed and sampled in January 1995. Data for this well have not yet been submitted to Ohio EPA. Thus it is unknown if the samples obtained from this well are representative of background water quality at the site.

2. Wells MW-1 and MW-2 are actually located within the drum storage unit. Based on previously collected data (1989 and 1994), MW-3 is downgradient of the limits of the storage unit. Additional water level elevation data are needed to comfirm that the ground water flow direction has not changed or that seasonal or temporal variations do not occur in the ground water flow direction.

3. The facility began ground water monitoring in the assessment phase as part of closure activities.

4. See comment 3.

5. Supplemental Annual Report Forms for Ground Water Monitoring Data have not been submitted by the company during the compliance period under evaluation.

APPENDIX A-2
INSPECTION COMPLIANCE FORM FOR A FACILITY THAT HAS DETERMINED IT MAY BE AFFECTING GROUND WATER QUALITY

Company Name: Vernitron Piezoelectric Div. EPA I.D. Number: OHD 052 324 290

Company Address: 232 Forbes Road Bedford, OH

Company Contact/Official: Mr. Kenneth Kupcak Title: Manager

Date of Inspection: January 27, 1995

Inspector's Name: Todd R. Fisher Branch/Organization OHIO EPA / NEDO / DDAGW

Type of facility: (check appropriately)	Y/N
a) surface impoundment	N
b) landfill	Y
c) land treatment facility	N

Ground Water Monitoring Program		
1. Has (Have) comparison(s) of ground water contamination indicator parameters for the upgradient well(s) 3745-65-93(B) shown a significant increase (or pH decrease) over initial background?	N/A	*1
A. If "Yes," has(have) the increase(s) been submitted to the Director as part of the annual report? 3745-65-94(A)(2)	N/A	
2. Have comparisons of indicator parameters for the downgradient wells 3745-65-93(B) shown a significant increase (or decrease) over initial background?	N/A	
A. If "Yes," were additional ground water samples taken for those downgradient wells where the significant difference was determined? 3745-65-93 (C)(2)	NA	
1) Were samples split in two?	N/A	
2) Was the significant difference due to laboratory error? (If "Yes," do not continue.)	N/A	
3. If significant differences were not due to laboratory error, was a written notice sent to the Director within 7 days of (laboratory) confirmation? 3745-65-93(D)(1)	N/A	
4. Within 15 days of notification of the Director was a ground water quality assessment plan (GWQAP) submitted? 3745-65-93(D)(2)	NA	*2
A. Does the GWQAP specify the following: 1) Hydrogeologic conditions at the facility? 3745-65-93(D)(3)(a)	Y	
2) The detection monitoring program implemented by the facility, including, but not limited to:	Y	

Y - YES, N - NO, NA - NOT APPLICABLE
NS - NOT SPECIFIED, * - COMMENT

APPENDIX A-2	Y/N
a) The number, location, depth, and construction of detection monitoring wells with written documentation? 3745-65-93(D)(3)(b)(i)	Y
b) A summary of detection monitoring analytical data with written documentation of the results? 3745-65-93(D)(3)(b)(ii)	Y
c) A summary of statistical analyses applied to the data? 3745-65-93(D)(3)(b)(iii)	N/A
3) The investigative approach to be followed during the assessment, including, but not limited to: a) The proposed number, location, depth, installation method, and construction of monitoring wells? 3745-65-93(D)(3)(c)(i)	Y
b) The proposed methods for gathering additional hydrogeologic information? 3745-65-93(D)(3)(c)(ii)	Y
c) The proposed use of supporting methodology (e.g., soil gas analysis, geophysics)? 3745-65-93(D)(3)(c)(iii)	Y
d) The proposed methodology for determining contaminant migration rates? 3745-65-93(D)(3)(c)(iv)	Y
4) Sampling and analysis procedures as specified under paragraph (A) of Rule 3745-65-92 of the Ohio Administrative Code? 3745-65-93(D)(3)(d)	Y
5) Proposed data evaluation procedures, including, but not limited to: a) Utilization of statistical data evaluation? 3745-65-93(D)(3)(e)(i)	Y
b) Utilization of computer models? 3745-65-93(D)(3)(e)(ii)	Y
c) Criteria that will be utilized to determine if additional assessment activities are warranted? 3745-65-93(D)(3)(e)(iii)	Y
6) A schedule of implementation? 3745-65-93(D)(3)(f)	Y
B. Does the plan allow for determination of: 1) Rate and extent of migration of hazardous waste constituents? 3745-65-93(D)(4)(a)	Y
2) Concentrations of the hazardous waste or hazardous waste constituents? 3745-65-93(D)(4)(b)	Y
C. Is it indicated that the 1st determination was made as soon as technically feasible? 3745-65-93(D)(5)	N/A
1) Within 15 days after determination, was a written report containing the assessment of ground water quality submitted to the Director?	N/A
D. Has it been determined that hazardous waste or hazardous waste constituents from the facility have entered the ground water?	Y

Y - YES, N - NO, NA - NOT APPLICABLE
NS - NOT SPECIFIED, * - COMMENT

APPENDIX A-2	Y/N	
1) If "No," was the original detection evaluation program, required by OAC Rule 3745-65-92 reinstated?	N/A	
a) Was the Director notified of the reinstatement of the program within 15 days of the determination? 3745-65-93(D)(6)	N/A	
E. If it was determined that hazardous waste or hazardous waste constituents have entered the ground water: 1) For facilities where the program was implemented prior to final closure, have determinations of hazardous waste or hazardous waste constituents continued on a quarterly basis? 3745-65-93(D)(7)(a)	N	*3
2) Were(are) records kept of the analyses and evaluations specified in the ground water quality assessment plan throughout the active life of the facility? 3745-65-94(B)(1)	Y	
a) If a disposal facility, were (are) records kept throughout the post-closure period as well?	N/A	
F. Are annual reports submitted to the Director containing the results of the ground water quality assessment program? 3745-65-94(B)(2)	N	*4
1) Do the reports include the calculated or measured rate of migration of hazardous waste or hazardous waste constituents?	N/A	
2) Have the annual reports been submitted by March 1 of the following year?(3745-65-75(F))	N	

Y = YES, N = NO, NA = NOT APPLICABLE
NS = NOT SPECIFIED, * = COMMENT

APPENDIX A-2 COMMENTS

1. The facility began ground water monitoring in the assessment phase a part of closure activities.

2. The company submitted a GWQAP as part of its closure plan when directed to do so by the Ohio EPA in 1992.

3. The company has not collected and analyzed ground water samples on a quarterly basis as required by OAC 3745-65-93(D)(7).

4. Supplemental Annual Report Forms for Ground Water Monitoring Data have not been submitted by the company during the compliance period under evaluation.